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ABSTRACT

Stategies for organizing data on a district's energy use are presented in this guide, originally intended for use in California schools. Also presented are methods of communicating this information to those involved in planning, in recordkeeping, and in motivating staff and students to save energy. The energy accounting system offered in the first section of the guide consists of five sequential tasks: (1) selecting a method of analysis (four possibilities are suggested); (2) establishing an energy inventory and a baseline from which to measure energy usage in subsequent years; (3) developing a system for ranking the energy efficiency of different sites; (4) designing a monitoring system; and (5) initiating a regular system of communication. The second section of the guide considers such practical aspects of communication as reaching the right audiences, recognizing achievement, and using proper formats for easy-to-understand graphs, tables, and presentations. Appendixes explain how to report energy data with temperature corrections, and how to translate utility bills. (PGD)

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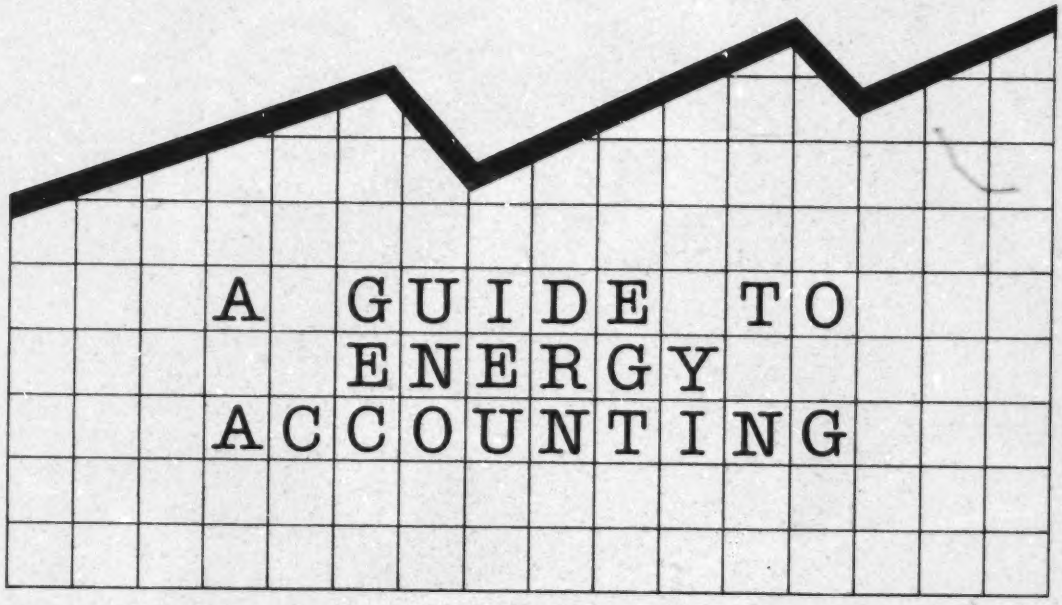
How to Organize and Communicate Your Energy Data



CALIFORNIA ENERGY EXTENSION SERVICE

EA 017 279

1984

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The California Energy Extension Service (CEES) is an energy management action program of the Governor's Office of Planning and Research. CEES works with school districts and professional education and energy management associations to develop programs that promote energy efficiency in schools by providing direct, personalized services at the local level. Those who are interested in the services offered may receive regular updates on CEES activities by subscribing to *SaveEnergy* which is available free of charge from the CEES office. Other publications available free of charge which may be of interest to you or your staff relative to school site energy management programs include *How to Motivate Staff and Students to Save Energy*, and *Animated Bibliography: A Sampler of Energy Education Materials*.

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Introduction

If someone wanted to know how much money your district spent on electricity and natural gas this month compared to the same month last year, how long would it take you to get the answer back to them? If you thought to yourself, five minutes, then your district's energy usage data is probably organized into an easily readable and informative report that you merely had to pull out of your file. If you threw up your hands at such a request, then all the information from your school's monthly utility bills probably is sitting in the file under "accounts payable".

The basis for an energy management program is data on energy usage trends. Many districts have found that sustaining an energy management program is easier with an organized information system. In Napa Valley Unified School District, two steps in their ten-step program relate directly to communication both in developing the energy program and recognizing outstanding achievement. A recent memo from that district states "The major contributing factor toward reducing energy consumption between 1975-80 was communication." In addition to controlling usage with *technology* or hardware, districts can manage costs with *information* or software. Regular updates on success are an effective incentive for districtwide participation. That's what this guide is all about: effectively communicating energy usage. This is what motivates people to take action; actions save energy and dollars. Each dollar not spent on energy is then available for other purposes.

We hope this guide will help you by suggesting some strategies for organizing energy data. With these strategies, you can know at a glance how much energy is being used, where it is being used, how much it costs and how much cost has been avoided. You will see how to format the information for decision makers, organize your records so they are easy to use, analyze your bills to answer those tough questions about where your energy dollars are going, prioritize the sites that need attention and district investments in energy efficiency and communicate that information so that staff and students will be motivated to manage school site energy usage. That's ENERGY ACCOUNTING, a formal way to record and analyze energy cost and use.

CHECKLIST FOR USING ENERGY ACCOUNTING

To initiate your program by

- identifying critical sites for energy audits or surveys
- providing a comparison between your district and others
- prioritizing activities
- ranking capital investment opportunities
- demonstrating to the public that the district is willing to control costs and provide savings to the taxpayer

To create awareness by

- sharing data with board members, administrators, maintenance and custodial staff, teachers, staff and students
- organizing data by site
- giving recognition for the greatest savings

To evaluate program success by

- comparing data year to year, month to month, etc.
- comparing data for different sites within the district
- establishing a base year to compare progress
- calculating cost avoided and dollars saved

To create incentives for greater participation by

- returning a percentage of the savings to those at the school site responsible for the program success
- informing site administrators of their success
- purchasing "hardware" to make energy management easier and more effective
- preparing proposals for funding based on program success
- comparing particular sites or buildings with others in the district, region and state

To fine-tune and expand program by

- setting priorities for action based on simple paybacks
- identifying trouble spots on a monthly basis—e.g., high consumption months or sites
- noting long-term trends
- identifying which strategies work best at which schools
- identifying particularly effective site energy managers who might assist their peers
- justifying requests for funding

ENERGY ACCOUNTING BEGINS AND ENDS WITH DECISION MAKERS

All of us have been jolted by skyrocketing energy bills. When today's sophomores entered kindergarten, annual pupil energy costs were $20; by the time these students graduate, the American Association of School Administrators predicts that per pupil costs will rise to nearly $300 per year including transportation. The cost of energy is one of the fastest rising expenses in a school district's budget. Unless those costs are brought under control, funds that would have been used for educational programs will be diverted to pay for operating costs.

Many districts in California have recognized that a successful energy management program begins with commitment from the Board of Education and the Superintendent. One of the barriers identified by those districts is the difficulty of tracking and managing their programs because they cannot readily interpret the savings from their bills. School districts may have inadequate records; there is no responsibility for controlling costs at each school and little staff time available for the analysis of utility bills and rate schedules. Energy management efforts suffer because of it. That's where ENERGY ACCOUNTING comes in. It begins and ends with decision makers whether the business office, principal or superintendent because it supplies the information that *they* need to make decisions. An analysis of data makes it possible to:

- identify opportunities for energy management programs
- regulate site energy use through ongoing monitoring
- evaluate the effectiveness of the district's energy program
- budget for energy costs, retrofits and in-service training

Whatever the decision at hand, the data must be presented in a manner that meets the decision makers' needs and stimulates their interest.

PART ONE:
How to Organize Your Energy Data: An Energy Accounting System

Accounting is a method that allows you to regularly record and summarize the financial transactions of a business to analyze, verify and report the results. The methods used in energy accounting are very similar to traditional accounting. Success is measured by changes in *consumption* which result in cost avoidance since the cost of energy changes frequently.

Implementing the energy accounting system involves five simple tasks. To progress from one task to the next involves a series of the steps and a set of decisions.

Task 1: Select a method of analysis.

Task 2: Develop an energy base line.

Task 3: Develop a ranking for site energy efficiency.

Task 4: Design a monitoring system.

Task 5: Initiate a regular system of communication/information sharing.

Once the top management within your district has established energy as a priority, you are in a position to ask for the resources—in terms of management support, skills, staff, and money that are needed for energy accounting. Management support is critical to ensure that staff will be assigned responsibility for collecting and formating the data. It may be a good idea to raise the profile of this assignment and emphasize its importance with a step increase or stipend if this is an additional duty. To function, the records need to be kept up-to-date and accurate.

Task 1: Select a method of analysis

This first task sets the groundwork for the entire energy accounting program. The base line, the ranking and monitoring systems will be designed using the same "logic" or method of analysis. All four of the methods compare current usage to historical usage. What distinguishes the methods from each other is the degree to which they account for the many variables that influence energy use on a campus. Energy use can be broken down into three classes of usage according to a report by Lawrence Berkeley Laboratory (LBL-10114 Preprint, November 1979). The first is "base use," which is the energy required to maintain the campus, independent of the weather, and utilization of buildings. Some security lights, thermostated rooms, hot water heaters, refrigerators and other appliances *may* be in operation year-round. The second is "heating/cooling use" which is dependent primarily on the outside air temperature, weather, and site design. The third, "program use" is the energy required to conduct the academic programs—the lights in the classroom, the gas kiln in ceramics class, Bunsen burners in chemistry labs, etc. and will depend primarily on the number of students, their academic programs and other groups who may use the facilities after hours. The addition of these variables may increase the accuracy of the comparison from year to year, but complicates the monitoring and analysis. The bottom line however—energy usage and cost—is always accurate. The district will have to pay energy bills regardless. The benefits of each method are highlighted below.

- **Present-to-Past Comparison**

  The "present-to-past" method is the easiest to initiate and update because the utilities have already done most of the work for you. Your utility bill includes a column "energy use same time last year" which allows a yearly comparison. This clearly indicates whether energy use has decreased or not. You can determine avoided cost by subtracting the present use from last year's figure. Multiply this difference by the present cost of the energy to find the cost avoidance or increase.

- **Multiple Year Monthly Average**

  This method averages energy use from similar time periods to develop a base line for comparison. For example, the use for the months of January 1981, 1982, and 1983 can be averaged and compared to the use in January 1984. Variations due to a number of variables (particularly weather) are "smoothed out" to provide a more realistic base line for comparison. The more years you include in the average, the more accurate this method is for establishing the base line for heating and cooling.

  It is also possible to obtain a computer print-out from the

utility of your school's energy use for the past five years. PG&E, for example, is able to provide this print-out in approximately three weeks. The major drawback of this type of comparison is that it does not account for temperature fluctuations between different years. While temperature changes do not generally affect lighting, they do affect heating and cooling fuel use. If your energy management program is focused on lighting in a gas heated and cooled school, this print-out will make it easy to establish a base line and energy management goals.

- **Temperature Connected Method—Heating Degree Days**

  This method is more complicated, primarily because you must obtain data not found on the utility bill. Many find the accuracy worth it. Essentially, this is a "normalizing" method that accounts for changes in outside air temperature, which determines the need for heating by using heating degree days (HDD). The number of HDD in a month is summarized and reported by the National Climatic Center and gives an indication of how hard the heating system had to work to keep the building warm. The Educational Facilities Laboratory has established that fuel consumption for space heating in schools is directly proportional to outside air temperature which HDD will measure. Besides providing an accurate comparison between years, this method can be used to develop an idealized graph to predict energy usage. This method is explained in more detail in APPENDIX A though there are many pitfalls as well. Usually, the current ratio is compared to the base line year's ratio in order to evaluate changes in consumption. Although it sounds complicated, the calculations are simple with a calculator or microcomputer.

- **Modeling**

  Modeling is a technique similar to normalizing; it allows energy usage to be predicted and is the most complicated and theoretical of the methods. It has the potential to be just as inaccurate as the past-to-present method, albeit more complicated. Mathematical expressions are developed from historical usage data and are used as "models" to predict future energy usage, particularly changes in base usage and program usage. More variables such as attendance data, nighttime use of facilities, changes in appliance efficiency, and the impacts of programs like "energy patrols" can be incorporated into such models. The user should be warned that there are limits to the accuracy of such models. Costs involved in developing, validating and maintaining such models limit their cost effectiveness and applicability.

Special factors which effect a school's energy use can be accounted for in less sophisticated and yet accurate ways. Let's say that you noted a great increase in energy usage in January for no apparent reason. Upon investigation you discovered a continuing education course began meeting three nights a week. A simple method to account for this change is to ask the nighttime custodian to read the meter for a week and find an average use for the three nights. Subtract the average nighttime use from the average class night use. Multiply the number of class nights by that difference and subtract it from the school's bill.

A similar method can be used if portables are added or buildings shut down. Assume that each square foot of building on campus used the same amount of energy as any other. Simply take the total energy use of your facility during the base line year and divide it by the square footage of the facility to arrive at an energy use per square foot. If a certain building was shut down, simply subtract the energy use per square foot for that building from your base line usage to arrive at an expected usage for the period when the building was shut down.

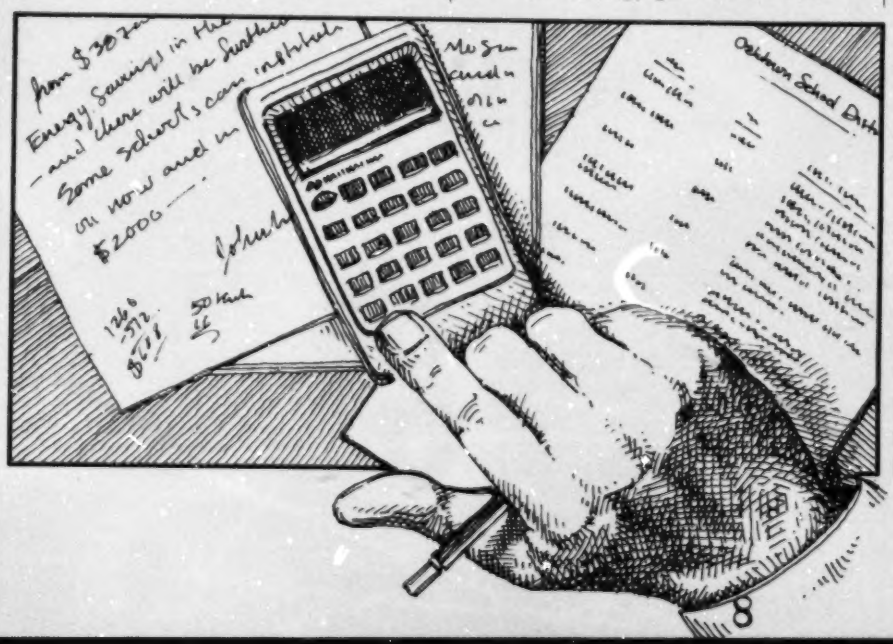
DECISIONS:

What method is most workable for me?

How detailed does information need to be for the decisions we're making?

Will I be able to follow through or am I too ambitious?

Is it worth it to collect degree-day information or develop a modeling program?



Task 2: Develop an energy inventory or base line

It's one thing to know what should be done in an ongoing program of energy accounting, but quite another to actually *do* some of the regular, repetitious tasks to report, validate and analyze the data. The first time, it may take two to three months to gather all the data you will need. In El Dorado County, it took one month. In Berkeley USD, it took about seven months. Here are some steps districts have used:

Step 1: Identify Energy Sources for Each Building or School

Locate, inventory and label the energy sources and their respective meters and gauges for each heated or cooled building both on-site and on a master blueprint. If the maintenance/custodial staff doesn't know where the meters are, the utility meter readers do!

Be sure that meters are calibrated and operating properly even though this is legally the responsibility of the local utility.

List the meters for each building at the school. Link each building to a particular utility account and find out where those bills are sent and who receives them.

Step 2: Select the "Base line" Year as a Standard of Comparison

If an energy management program has been in place for some time, the year prior to its initiation would be appropriate. In other cases, you may decide to use the year with the lowest consumption thus far or the previous academic year.

Step 3: Record Energy Usage Data for the Base line Year

Obtain copies of utility bills for the base line year to gather that data. The records for that year may be sketchy or difficult to track down. You may even need to go to the files yourself and pull the records if the bookkeeper is very busy. If you do not have copies of the utility bills, the local utility may have the records you need. Some utilities will provide a print-out of energy usage for the past five years. For propane, delivery billings may be the only consumption records. Since most schools fill storage tanks when they run out, one "purchase" may not reflect a standard period of usage. (If this is a significant problem, fuel use meters can be installed on the tank or each burner to help you *monitor* use.) You may have to "guesstimate" to establish the base line.

Record all information available from the bills on a master record. Items you may want to include are: consumption, cost, demand, unit

PACIFIC GAS AND ELECTRIC COMPANY 10/25/83

ENERGY CONSERVATION SERVICES — EUA STATEMENT OF ACCOUNT SOA ONLY — REQUESTED BY B D HOLLAND — PAGE 2 ROOM 0119
PS

CONTROL NUMBER 0897581
AUDIT NUMBER 0885536 AUDIT SUFFIX

CUSTOMER NAME MOTHER LODE SCHOOL
SERVICE ADDR CHARLES BROWN SCHOOL DIAMOND SPG CA 95619

AVERAGE CALENDAR MONTH

SCHEDULE A 12 — ELECTRIC - KWH						SCHEDULE — GAS - THERMS					
YEAR -	83	82	81	80	79		00	00	00	00	00
JAN	27234	23936	16701	21802	36821	JAN	0*	0*	0*	0*	0*
FEB	21752	20275	15963	20649	32359	FEB	0*	0*	0*	0*	0*
MAR	22529	19904	16790	18594	28469	MAR	0*	0*	0*	0*	0*
APR	20516	16250	13458	16958	22339	APR	0*	0*	0*	0*	0*
MAY	17000	11934	10762	15608	18420	MAY	0*	0*	0*	0*	0*
JUN	9880	7586	6670	8429	10733	JUN	0*	0*	0*	0*	0*
JUL	4360	4640	3299	4768	7323	JUL	0*	0*	0*	0*	0*
AUG	7280	7360	5844	7536	9557	AUG	0*	0*	0*	0*	0*
SEP	12150	12321	10766	11519	12934	SEP	0*	0*	0*	0*	0*
OCT	6450*	16596	14668	14351	15564	OCT	0*	0*	0*	0*	0*
NOV	0*	21518	16672	16811	18767	NOV	0*	0*	0*	0*	0*
DEC	0*	27494	19908	16746	19741	DEC	0*	0*	0*	0*	0*

MOST RECENT 12-MONTH USAGE TOTAL - 207429 KWH

MOST RECENT 12-MONTH USAGE TOTAL - 0 THERMS

Pacific Gas and Electric will provide a EUA statement of account for energy use over a five year period.

1983-84 EL DORADO COUNTYS' COST OF ENERGY PER SQUARE FT. AND PER STUDENT

SCHOOL SITE	$$$ PER SQ. FT.
LATROBE ←	.21
PINEWOOD	.42
BUCKEYE	.44
W. BROOKS	.45
BUCKEYE DO	.50
C. BROWN	.52
H. GREEN	.53
GOLD.SIERRA	.54
PONDERADO	.54
CAMERADO SPS	.56
NORTH SIDE	.57
SCHNELL	.60
PONDEROSA	.61
EL DORADO HS	.61

1983-84 EL DORADO COUNTYS COST OF ENERGY PER SQUARE FT. AND PER STUDENT

	$$$ PER STUDENT
C. BROWN	26
PACIFIC ST	29
BUCKEYE	31
P. PINES	35
W. BROOKS	36
GOLD TRAIL	37
H. GREEN	38
PIONEER	38
PINEWOOD	40
SCHNELL	41
SIERRA	42
GEORGETOWN	42
NORTH SIDE	43
LATROBE ←	45

EXAMPLE 1 Cost of Energy Per Square Foot and Per Student in El Dorado County, 1984 Note where Latrobe falls in each of these rankings.

cost, service dates, consumption per day, rate schedule, account number, prior year usage (for bills you don't have). APPENDIX B will provide information on "translating" those bills. This data will help you when you begin monitoring energy usage on a regular basis. For example, you will need to know that the number of days in a billing period is the same in order to compare usage from year to year.

Step 4: Collect Other Data that Influences Energy Consumption

The data will be determined by the needs of your decision makers, e.g., cost avoidance, percentage change, etc. Some of the factors might include the characteristics of the buildings (square footage of conditioned space, type of building use, date of retrofit, hours of occupancy, etc.) and climate data. Square footage may be estimated from blueprints, but have one person responsible for this task so the numbers will all be relative.

DECISIONS:

What will the base line year be?

Is it worth the effort to gather information other than gas and electrical usage?

What type of information should be recorded on the master record?

Task 3: Develop a ranking for site energy efficiency

Most districts want some way to compare sites be it for distributing rebates or retrofitting facilities. The design of your energy management program will dictate what type of ranking or goals you will establish. Regardless of your goals, most schools have decided not to compare sites directly because different sites perform different functions and have different capacities (type of heating system, large areas of windows, swimming pools).

The first step in developing an equitable measure is to group sites according to function. Within each functional group, energy use can be "normalized" as was discussed earlier, to compensate for the size of the site, the number of students or the type of energy used. However, each method will provide a different ranking, as in Example 1, so you may want to use more than one system, or different methods for different purposes. For example in one Bay Area district, regardless of what the site energy manager suggested, the district office did not make the low cost equipment changes needed to improve site energy efficiency. Her school remained last in the ranking through no fault of her own. To maintain her interest and enthusiasm, she was given a commendation for her effectiveness in energy management activities which were not reflected in the ranking.

Step 1: Group Sites According to Function

In Fremont, four groups were chosen: 1) full service high schools; 2) continuing education high schools; 3) junior high; and 4) elementary. This may not make sense for your district, but it is worth looking at the energy usage of your schools to see if any natural groups emerge.

Step 2: Select a Method for Comparing Schools

This step involves "normalizing" to place all sites within a group on a common basis. First you will need to decide whether to use overall energy use or total cost.

All sources of energy can be converted by simple arithmetic to BTUs or British Thermal Units. This is very simply a non-metric unit of measure used frequently by engineers. Overall energy use is usually the preferred method of comparison for evaluating progress. The total cost basis, just adding up the utility bill totals gives you the bottom line. This is the type of comparison administrators understand because energy can be compared to other program costs.

In addition, each of these indicators can be fine-tuned even more, depending upon how much information is available. Several common indicators are noted below:

— per square foot

— per degree day

— per student

The first, in Example 2, is often referred to as the "Energy Use Index" (EUI), which is defined by the ratio:

$$EUI = \frac{\text{Total energy use per year}}{\text{Total square feet}}$$

This method is similar to measuring the efficiency of an automobile in miles per gallon. Unfortunately, it assumes that the energy use at Lake Tahoe is the same as in Palm Springs. To compensate for this, you can add one more variable, degree days which was discussed earlier in the section on selecting a method of analysis.

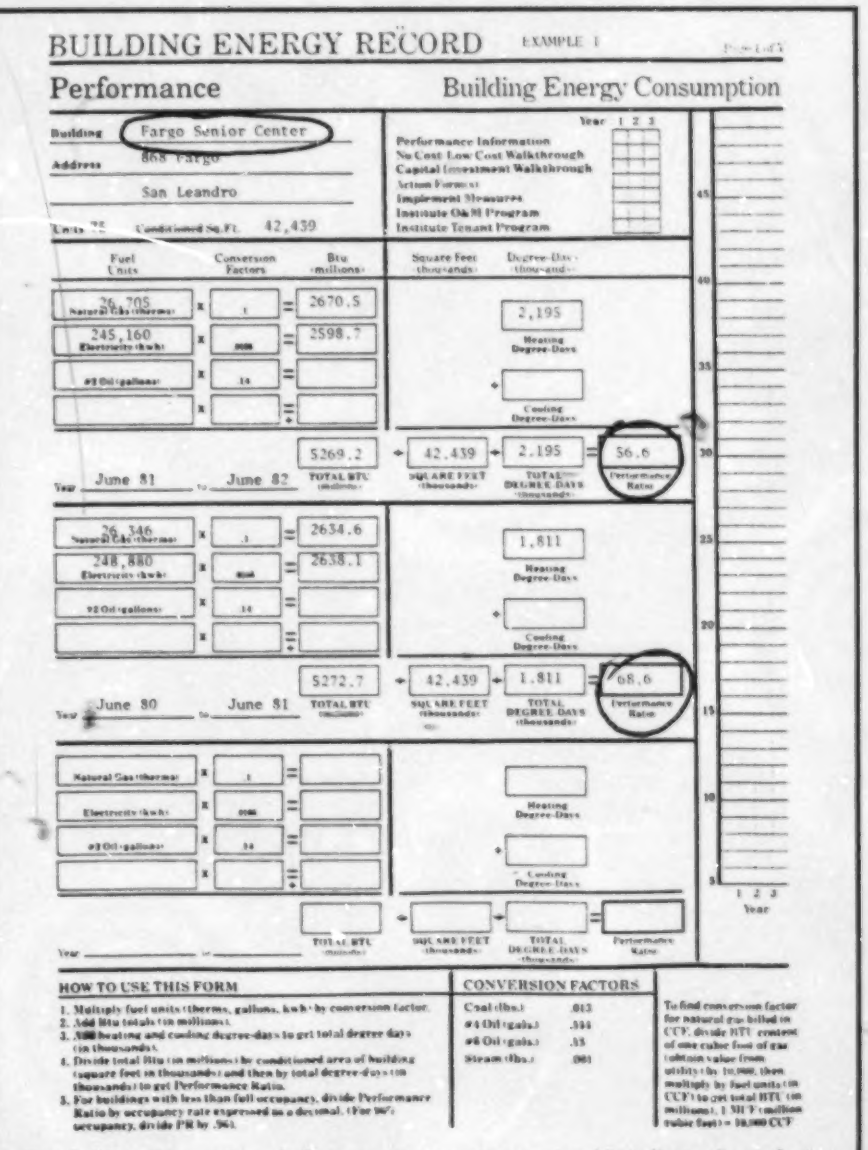
As you can see from the Building Energy Record and Example 3, the performance ratio is a single number that allows an easy ranking and compensates for fluctuations in temperature and multiple energy sources.

A method that is gaining in popularity is Energy Used per Average Daily Attendance (ADA) because it allows you to compare energy costs per student to material costs and other program costs to illustrate the relationship between a quality education and rising energy costs. It is useful for planning purposes if you know growth trends of your student body. Within each functional group, the standard probably will vary. For example, the goal in 1982 for elementary schools in Fremont was $11/student, for junior high—$21, for high schools—$40 and for continuing education—$30.

These methods of comparison and functional groups are also useful in designing a rebate system whereby schools that reduce their energy usage from that of the previous year receive a percentage of the savings to use for the educational purposes of their choice. There are several questions that typically arise when a district considers implementing a rebate system that you might want to consider before selecting a method of comparing or ranking schools.

- How will the program compensate for the variation in schools' past energy management efforts?

  Schools that have a history of energy management generally



BUILDING ENERGY RECORD EXAMPLE 1

Performance — Building Energy Consumption

Building: Fargo Senior Center
Address: 868 Fargo
San Leandro
Units: 22 Conditioned Sq.Ft. 42,439

Performance Information
No Cost Low Cost Walkthrough
Capital Investment Walkthrough
Action Formed
Implement Measures
Institute O&M Program
Institute Tenant Program

Fuel Units	Conversion Factors	Btu (millions)
36,705 Natural Gas (therms)	x 1 =	2670.5
245,160 Electricity (kwh)	x 3413 =	2598.7
#2 Oil (gallons)	x 14 =	
	x =	
		5269.2

Year June 81 to June 82 — TOTAL BTU (millions) 5269.2 ÷ SQUARE FEET (thousands) 42.439 ÷ TOTAL DEGREE DAYS (thousands) 2.195 = Performance Ratio 56.6

Heating Degree-Days 2,195
Cooling Degree-Days

Fuel Units	Conversion Factors	Btu (millions)
26,346 Natural Gas (therms)	x 1 =	2634.6
248,880 Electricity (kwh)	x 3413 =	2638.1
#2 Oil (gallons)	x 14 =	
	x =	
		5272.7

Year June 80 to June 81 — TOTAL BTU (millions) 5272.7 ÷ SQUARE FEET (thousands) 42.439 ÷ TOTAL DEGREE DAYS (thousands) 1.811 = Performance Ratio 68.6

Heating Degree-Days 1,811
Cooling Degree-Days

Natural Gas (therms) x 1 =
Electricity (kwh) x 3413 =
#2 Oil (gallons) x 14 =
x =

Heating Degree-Days
Cooling Degree-Days

Year ____ to ____ — TOTAL BTU (millions) ÷ SQUARE FEET (thousands) ÷ TOTAL DEGREE DAYS (thousands) = Performance Ratio

Performance Ratio 5 10 15 20 25 30 35 40 45
1 2 3 Year

HOW TO USE THIS FORM

1. Multiply fuel units (therms, gallons, kwh) by conversion factor.
2. Add Btu totals (in millions).
3. Add heating and cooling degree-days to get total degree days (in thousands).
4. Divide total Btu (in millions) by conditioned area of building (square feet in thousands) and then by total degree-days (in thousands) to get Performance Ratio.
5. For buildings with less than full occupancy, divide Performance Ratio by occupancy rate expressed as a decimal. (For 90% occupancy, divide PR by .90).

CONVERSION FACTORS

Coal (lbs.)	.013
#4 Oil (gals.)	.144
#6 Oil (gals.)	.15
Steam (lbs.)	.001

To find conversion factor for natural gas billed in CCF, divide BTU content of one cubic foot of gas (obtain value from utility) (ie. 1000, then multiply by fuel units (in CCF) to get total BTU (in millions). 1 MBTU=million cubic feet= 10.000 CCF

The Building Energy Record allows you to generate a comparable indicator for each site.

EXAMPLE 2 Summary of Energy Usage for Acalanes UHSD

ACALANES UNION HIGH SCHOOL DISTRICT
SUMMARY REPORT OF ENERGY USAGE I TE'S

JULY-DECEMBER 1980-81/1981-82

ENERGY UTILIZATION INDEX = BTU'S / SQ. FT.

	80-81	81-82	%
DISTRICT OFFICE	4.65	8.60	- .3
TRANSPORTATION	3.01	2.72	- 11
MAINTENANCE	2.11	2.05	- 6
ACALANES	6.36	5.46	- 14
CAMPOLINDO	3.70	3.86	+ 4
DEL ORO	2.64	2.64	0
DEL VALLE	2.80	1.63	- 42
LAS LOMAS	3.94	2.78	- 30
MIRAMONTE	3.48	3.33	- 4
TOTAL	4.01	3.44	- 14

Th = $ .660 KWH = $ .071

A.D.A.	5,970	5,571	- 7%
Average BTU per student	41.99	38.61	- 8%
Average cost per student	$36.67	$38.00	+ 4%

The EUI provides a single number by which each school is ranked.

The average cost per student allows energy to be compared with supplies or books.

ENERGY USE (BTUs) PER SQUARE FOOT PER DEGREE DAY

1981-82		1980-81	
Building	Indicator	Building	Indicator
1. ST. MARY'S GARDEN	26.8	1. ST. MARY'S GARDEN	32.0
2. WESTLAKE WEST	46.1	2. WESTLAKE WEST	55.6
3. SOUTHLAKE TOWER	49.0	3. SOUTHLAKE TOWER	57.6
4. LAS CASITAS	50.9	4. LAS CASITAS	63.5
5. FARGO SENIOR CENTER	56.6	5. FARGO SENIOR CENTER	68.6
6. POSADA DE COLORES	56.7	6. WESTLAKE EAST	73.5
7. WESTLAKE EAST	62.2	7. BETH EDEN	74.3
8. BETH EDEN	67.0	8. POSADA DE COLORES	76.9

EXAMPLE 3 Energy Use Per Square Foot Per Degree Day for Nonprofit Multi-family Buildings in Alameda County

The performance ratio from the Building Energy Record was used to develop this table.

argue that they should receive a greater percentage of return than schools that do not have a track record of cost avoidance because it is more difficult to achieve the second 10% of energy reduction than the first 10%.

- How will the program compensate for the variation in energy usage between schools due to differences in square footage, student population or activities such as public swimming, day care or night school?

  Schools with a smaller EUI or energy use per square foot or those that spend less per student for energy argue that they should receive a greater percentage of the return than high energy use schools because they have less potential for savings.

  This may or may not be true. Examples can be found to the contrary if you look hard, but the issues are worth considering before designing a rebate system. Staff at the California Energy Extension Service have examples of rebate programs that have successfully grappled with these issues.

Step 3: Cross-check your Ranking with a Site Visit, Phone Call or Utility Audit.

You may want to investigate apparent inconsistencies in person or on the phone to understand why the ranking appears as it does. A building with a relatively low energy use in the past may still have more room for improvement or reduction in energy consumption than a traditionally high energy user. This is primarily due to the number of factors that determine the building's energy use—factors which cannot always be modified at a low cost. On the other hand, you may discover some unexpected things. At one school in Shasta County, energy use went way up in the summer. It turned out that they were irrigating six acres with a well pump which no other school was doing. Not only did this discovery suggest additional energy management practices, but by subtracting this unusual summer usage, their ranking was more in line with what it should have been compared to the other schools.

DECISIONS:

What type of ranking will be most useful?

Will the ranking be a positive incentive to participate?

Do we have all the data we need to rank the schools?

What units will be used for the energy records?

School rebate rates from the BERTS project, Berkeley USD, 1984, that note special cases.

3/1/84
To: Principal of schools involved in BERTS project
From: Andrea Denver
Page 2

A special case

Thousand Oaks has been the most energy efficient school in the district for the past three fiscal years. Two audits of the school have been performed and there appears to be few, if any, additional low cost/no cost energy conservation measures that can be undertaken by the school's staff. They should not be penalized for having operated efficiently in the past. Therefore, for every month that their electricity and/or natural gas consumption does not increase they will receive a guaranteed rebate (or rebates). Their guaranteed rebate will be the average rebate per student received that month by the next four most energy efficient schools multiplied by Thousand Oaks' November attendance figure.

Task 4: Design a monitoring system

Once you record the energy accounts that correspond to each building at each school site, and determine the information you need to rank the schools and prioritize actions, it's time to establish a procedure for gathering energy consumption data on an ongoing basis. This may be a tedious task initially, but it gets easier.

Step 1: Assign Responsibility for Organizing the Data.

This may be out of your control if the Board or Superintendent has someone in mind. A clerk or the person who pays the bills often keeps the energy records. The energy manager may also want to keep records since they have a "vested" interest in the task being completed.

It is important that the task, although it may only take 5-10 minutes every month, is given some priority both in terms of that person's responsibilities and the overall energy management program. If the person organizing the data does not normally participate in the district energy committee, it might be worthwhile to invite them to one or two meetings so that they understand how the numbers they "crunch" become useful. Recognition may help to ensure that the records are up-to-date and accurate.

Step 2: Learn How to Read Meters to Verify your Bill.

In most cases, utility staff are happy to visit a school and explain how to read both consumption and demand meters or provide lesson plans for such activities. Some teachers have found meter reading to be a worthwhile academic activity. Student interest and questions spark further interest for staff and administrators to stay on top of energy consumption.

EXAMPLE: High school students at Foothill High School in the East Side UHSD discovered that their district had been overcharged one month. This happened because the utility read the school meter every other month. Towards the end of one 2-month period, there was a major rate increase. The school had been charged the higher rate for the entire two months. Since the students had recorded their meter readings every day during these two months, the bill was recalculated using the student readings and the district saved a substantial amount of money. It pays to read the electrical demand meter as well, as noted in the discussion of line graphs at the end of the guide. Demand should be lower in summer as school is not in full operation.

Students in business classes in Newark School District used the form in Example 4 as a worksheet but it could be used in a report as well. In some schools, students in math classes read the meters daily and then graph the results.

Step 3: Determine the Frequency of Data Collection.

Most schools find a MONTHLY collection of data to be sufficient to identify opportunities for energy management programs, maintain consistent site energy use and evaluate the effectiveness of the district's energy program. Some districts may report data quarterly or every six months. As the above example indicates, DAILY collection of data certainly lets you spot trends quickly and provides a check on your utility bills, but may draw attention away from the main focus of the program—energy management.

Step 4: Develop Forms for Recording Data

It may be helpful to design energy accounting forms with the person who will fill them in. They may have a particular system in mind that would make their job easier. You may have to "sell" them on the idea and be convincing that this is not extra work, but will make it easier to answer questions.

DECISIONS:

How often will data be collected?

What "routine" is most appropriate for the staff timeavailable?

What format is most appropriate?

Who will be collecting the data?

EXAMPLE 4 Utility Usage Form Used by Business Class

UTILITY USAGE — FISCAL YEAR

School:_____ Enrollment:_____

Gross Sq. Ft.:_____ Town:_____

(1) MONTH	(2) KWH	(3) x 3413 BTU	(4) $1,000,000 BTU	(5) COST	(6) COST/STUDENT	(7) COST/SQ.FT.
ELECTRICITY						
July						
Aug.						
Sept.						
Oct.						
Nov.						
Dec.						
Jan.						
Feb.						
Mar.						
Apr.						
May						
June						
Yrs. Tot.						
GAS	MONTH	THERMS	x100, 000BTU	$1,000,000 BTU	COST	COST/STUDENT	COST/SQ.FT.
July						
Aug.						
Sept.						
Oct.						
Nov.						
Dec.						
Jan.						
Feb.						
Mar.						
Apr.						
May						
June						
Yrs. Tot.						
DIESEL OIL	MONTH	GALLONS	x146, 000BTU	$1,000,000 BTU	COST	COST/STUDENT	COST/SQ.FT.
Yrs. Tot.						
Total Energy "BTU's" & Dollars				$/Student	BTU/ Student	$/Sq. Ft.	BTU/Sq. Ft.

Task 5: Initiate a regular system of communication

A decision to make now is whether to compile your energy data by hand or by computer. To a large degree, this depends on which method you will feel comfortable with. Not everyone is confident using computers. Remember that before you can computerize you need to work your system out by hand. If it doesn't work, the computer won't help you. These two options, manual vs. computer, are highlighted with reporting formats taken from school districts in California. Strategies for modifying the format for particular presentations or decisions are explored in PART TWO.

A Manually Completed Energy Report

A manual accounting system allows many calculations related to energy usage. The effect of weather on space conditioning and variations in attendance, ADA enter into the calculation quite easily. Simply add an extra column to your chart. Be sure to leave space for conversion factors if you will be using BTUs.

The chart used by Newark business students lists "kWh" and "therms" in column two and the conversion factor for on-site electricity use " x 3413 BTU" and for therms "—1,000 BTU" in columns three and four so that the calculations can be done right on the data entry sheet. This is particularly helpful if you need to retrace your steps to find an error. For each school, the non-energy and cost data is listed on the top of the form—"school", square feet", "enrollment", and "year". That information is used to calculate the ratio for columns six and seven.

To prepare the report should take from five to ten minutes once you set up your master chart whether it is by school site, month or year. This master chart or template is simply Xeroxed for data entry each month. Data such as conversion factors, month, school site and other factors which do not change on a regular basis become part of the master sheet. Each month, you extract the relevant information that will complete your analysis from your utility bill. See APPENDIX B, "Translating Your Utility Bill," for an explanation of where to find the rates, current charges, therm and kilowatt usage, etc. which you will enter. If you need assistance in developing the master data sheets, please contact the California Energy Extension Service at (916) 323-4388.

The energy report used by Acalanes Union High School District, Example 5, gives an instant overview of the district's total energy use. This format is used for monthly energy reports as well as for annual reports for an audience that wants a detailed comparison between schools. Each school is listed on the vertical axis, with the data for ADA and square

ACALANES UNION HIGH SCHOOL DISTRICT
ENERGY USAGE IN KWH
July - December, 1982

			1981-82			1982-83			1981-82/1982-83 % Change			$ Cost	
School	A.D.A.	Sq. Ft.	KWH	Rate	$	KWH	Rate	$	KWH	Rate	$	Actual	Avoided
District Off.	--	6,822	32,920	.077	2,521.32	34,777	.079	2,751.91	+6	+3	+9	+ 23059	167.92
Transportation	--	7,450	13,520	.080	1,082.99	12,793	.082	1,044.33	-5	+4	-4	- 3866	91.29
Maintenance	--	9,020	33,240	.078	2,603.96	29,640	.081	2,413.86	-11	+4	-7	- 19010	494.60
Acalanes	1378	112,446	365,732	.072	26,429.06	361,720	.075	27,201.75	-1	+4	+3	+ 77269	1,229.43
Campolindo	1327	135,788	494,880	.071	35,148.24	412,800	.075	30,914.91	-17	+6	-12	-4,23333	7,925.76
Del Oro	87	2,880	10,363	.076	788.90	9,816	.081	796.75	-5	+7	+1	785	137.57
Del Valle	--	130,696	341,880	.068	23,298.96	371,784	.075	27,721.42	+9	+10	+19	+4,42246	594.96
Las Lomas	1176	104,533	373,545	.070	26,256.90	352,730	.075	26,406.34	-6	+7	+1	+ 14944	1,815.33
Miramonte	1374	115,641	390,400	.070	27,368.20	390,320	.076	29,774.74	0	+9	+9	+2,40854	741.04
Total	5342	625,276	2,056,480	.071	145,496.93	1,976,780	.075	149,026.01	-4	+6	+2	+3 52948	13,19790

This information remains on the master sheet.

EXAMPLE 5 Kilowatt-hour Usage for Acalanes UHSD, July-December, 1982

SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

ENERGY EDUCATION/MANAGEMENT PROGRAM

1984-85
SMUD MONTHLY METER READINGS

NAME OF SCHOOL _____ METER NO. _____

Month	Base Line 3 Year Average 9/80-6/83		1980-81		1981-82		1982-83		1983-84		1984-85	
	KWH	KW Demand	KWH	KW Demand	KWH	KW Demand	KWH	KW Demand	KWH	KW Demand	KWH	KW Demand
SEPTEMBER												
OCTOBER												
NOVEMBER												
DECEMBER												
JANUARY												
FEBRUARY												
MARCH												
APRIL												
MAY												
JUNE												

EXAMPLE 6 Monthly Meter Reading for Sacramento City USD

Gives you a reference point that is not as complicated as HDD.

1984-85
PG&E MONTHLY CONSUMPTION-RATE COMPARISONS

NAME OF SCHOOL _____ ACCOUNT NO. _____

METER NO. _____

MONTH	(A) 3 Year Average in Therms (1980-83)	(B) Current Consumption in Therms	(C) Savings in Therms (A - B)	(D) Current Cost Per Therm	(E) Savings in Dollars (C x D)	(F) Accumulated Savings
SEPTEMBER				$.63587		
OCTOBER				$.63587		
NOVEMBER				$.63587		
DECEMBER				$.63587		
JANUARY						
FEBRUARY						
MARCH						
APRIL						
MAY						
JUNE						

EXAMPLE 7 Bi-Monthly Consumption Rate Comparisons for Sacramento City USD

The rate schedule could be printed on the back.

footage in column one and two. In column four, you find the cost of electricity or whatever fuel source you will be using. This information, in addition to the other column headings for "kWh", "cost", and "avoided cost" form the backbone of the master data entry sheet. A new form would be Xeroxed from this "master" sheet for each month.

The format developed by Sacramento City Unified School District, Examples 6 and 7, are for collecting monthly data for each school. The energy manager for the district has subsequenty modified her two master sheets and has six much simpler sheets. Electricity sheets include demand. As you will note in Example 7, each column has a letter from "a" to "f" as an identifier. Column "c" explains how the average is to be derived: column a - column b. Column "d" lists the cost which is multiplied by column "c" to derive the savings in column "f".

Computer-Generated Energy Reports

The appeal of a computerized energy report is that once the software is written or personalized for your site (incorporating the costs for each energy source, weather, and conversion factors for kWh, th, BTUs or other sources) and the monthly data entered, a variety of calculations or modifications can be performed with very little effort. In fact, the time required to maintain records and produce monthly reports for one site may be less than five minutes. The data entry sheets are similar to those used to prepare manual energy reports except that they are entered into a computer to complete the calculations of energy savings or cost avoidance. Different types of reports can be generated in minutes for different decision makers using the same master data sheets as in Example 8. "Dollar savings" replaces "percent change" in energy use. Decision makers might use the one to determine rebates and the other to make an awrd to the "best" school. The time required to set up the system can vary widely depending on the quality of existing records, the number and types of buildings and energy sources, and the expertise and priorities of the staff assigned to the project. Other advantages include ease of generating graphs, retrieving data and reformating reports, ability to store large quantities of data, and accuracy of your reports (if data is entered correctly).

DECISIONS:

Will the master sheets another district has developed work in your district?

Do you enjoy using computers?

Do you have the equipment (either micro or mainframe computer) readily available for you to use?

Is there software that meets YOUR needs?

Will you have to modify an existing software program for spreadsheet or data management? Or, will you have to develop your own software?

Do you want/need graphic capabilities for your reports? Is there someone in-house who understands programming and debugging, or will you have to go out to bid?

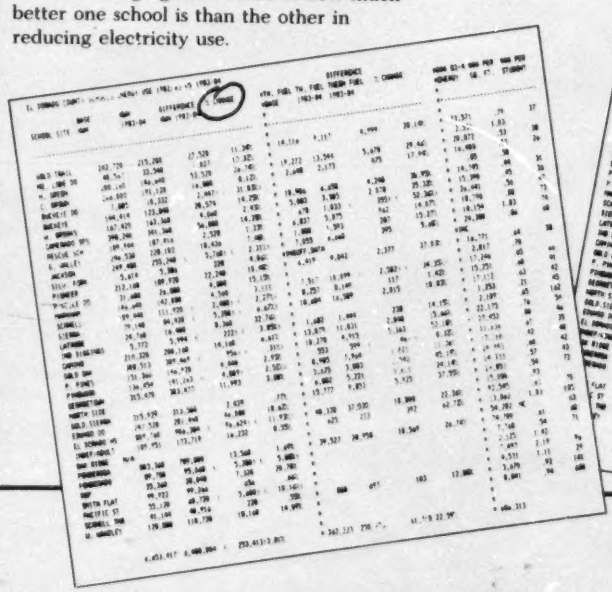
Is there someone in your department that is available on a regular basis for data entry?

Will your printers and/or graphics printer be compatible?

Will they print the quality report that you need?

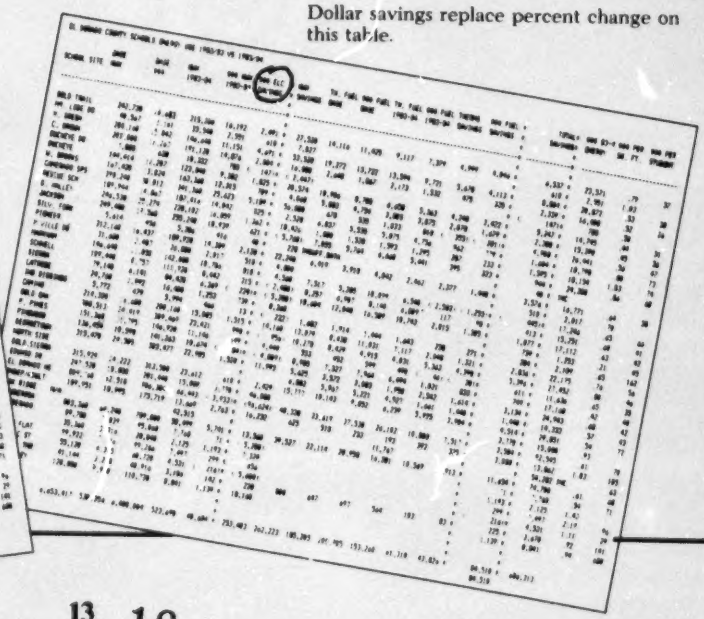
EXAMPLE 8 Percent Change in kWh Usage 1983-1984, El Dorado County Schools

Percent change gives a sense of how much better one school is than the other in reducing electricity use.



EXAMPLE 9 Dollar Savings in 1984, El Dorado County Schools

Dollar savings replace percent change on this table.



Computer Software Applications

SOFTWARE AVAILABLE

A couple of years ago, energy managers craved a reasonably accurate and easy method of handling monthly energy data for their schools. Finding nothing in the way of software, practitioners in local schools and associations in the United States and Canada have independently developed and modified software packages because they felt microcomputers were essential to streamline energy analysis and reporting. Most of the systems will summarize districtwide energy use by energy type, and list consumption at each site. Most will provide a comparison between energy types by converting to BTU's and rank sites by energy efficiency measured in energy units per square foot, per occupant or dollars per occupant/square foot. Some will calculate changes in energy use from year to year related to changes in outdoor temperature (degree days) or determine cost avoidance (the amount of money the district would have paid had it used last year's amount of energy at this year's rates compared to what actually was spent.)

Blake Heitzman, Fremont Unified School District, has developed M.A.U.D.S. (Multi-Account Utility Data System). This software, written in BASIC, is designed for use with IBM-PC (or IBM-PC compatible) and Osborne computers. It is designed to track utility bills for up to 100 sites and generate annual or monthly energy reports. Mr. Heitzman is currently looking for districts to pilot the software and will provide a diskette free of charge to those who are willing to help him fine-tune it. If interested, contact him at 40812 Creston, Fremont, CA 94538.

Some districts in California have found the Energy Monitor, developed by the Massachusetts Association of School Business Officials Coop Corporation, to be useful. MASBO makes this system designed for use with Applesoft on Apple II or TRS-80 III computers available for just under $300. Energy Monitor generates a set of six reports and will track from one to ninety buildings. Ordering information is available from MASBO, 99 School Street, Weston, MA 02193. CEES has samples of these reports.

This program has the capacity to calculate changes in energy use from year to year that are related to changes in outdoor temperature (degree days). It also calculates the difference in total energy costs between two years. The program does not calculate cost avoidance (the amount of money the district would have paid had it used last year's amount of energy at this year's rates).

Another system that may be of interest to some is one that uses the Lotus 1-2-3 software, an integrated package that combines electronic worksheets with data base management and graphics which is available for around $300. Energy Management Services, under contract during this last year to CEES, developed an energy monitoring program using this software for non-profit housing facilities. While not written for schools per se, this program can be run on IBM-PC, IBM-xt, COMPAQ Portable Computers, and others, and could be easily modified for schools. It also allows the manager to input data about energy audits and energy measures which have been implemented and is available through CEES.

As an outgrowth of the "Schools and Hospitals" grant program in the State of Wisconsin, the Division of Energy offers a computerized energy monitoring system statewide. Their system allows use of a variety of fuels including electricity, gas, fuel oil, propane, coal and wood. Iowa has a program called PECMAN (Program for Energy Conservation Management) that uses an IBM personal computer or Apple II. Idaho also offers a statewide tracking system, that can be replicated on local micro computer systems. CEES is exploring the possibility of establishing a statewide system in California based on the positive response to this system in Wisconsin and Idaho.

CEES will be undertaking a more thorough analysis of available software over the next year. Those mentioned here are by no means all that exist, but merely a sampling. If you are interested in developments in this field, or have personal experiences with other software, please contact Bonnie Cornwall, 1400 10th Street, Sacramento, CA 95814.

OTHER MICROCOMPUTER APPLICATIONS

The Apple II microcomputer has proven itself to be an essential ingredient in streamlining energy analysis. One program developed by schools in Alberta, Canada, stores monthly school electrical and natural gas consumption figures, and graphs these utility profiles with monthly heating degree days over a year. An energy efficiency figure is also calculated each month so that trends in energy performance can be determined.

A life cycle costing program aids in calculating true paybacks in energy saved for various retrofit proposals. Equipment depreciation and life expectancy, energy cost escalation and interest rates are all taken into account.

Another program in use is a modified version of a software package called "F-LOAD." This program models the energy use of a school building over a year. Information on construction, equipment, and occupants, is taken into account by the software. The output gives an indication of areas with large heat losses which should receive attention in the school. Different retrofits can also be simulated to determine each one's effect on overall energy use.

PART TWO:
How to Communicate Your Energy Use to Decision Makers and Staff

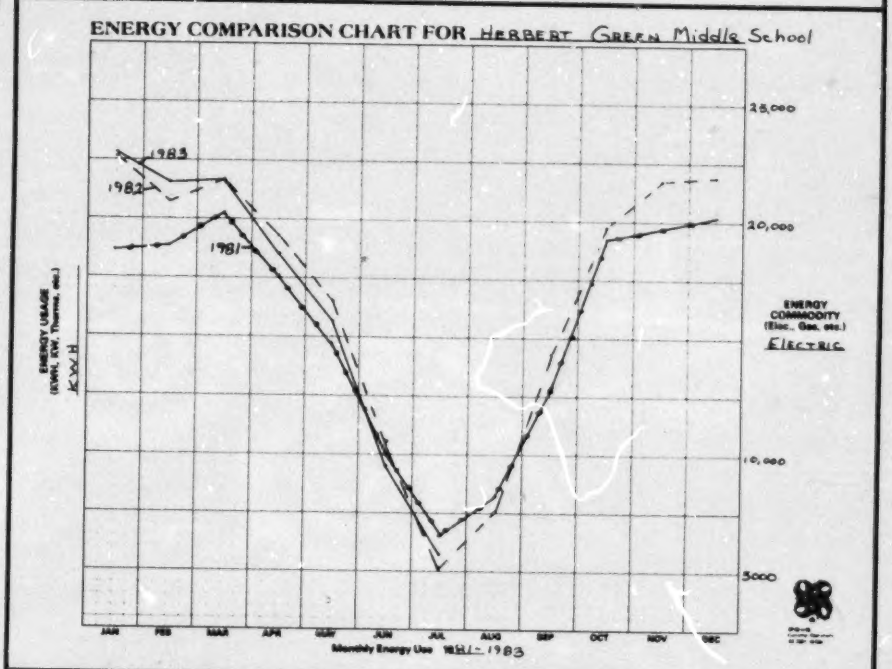
What Should It Look Like?

You are trying to communicate amid a blizzard of paper, words and images—all competing for your readers attention. Staff cooperation, support and action begin with effective communication. Define your audience and try to accommodate them. Staff generally do not have the slightest idea how much it costs for the energy to operate the school; a quick quiz will heighten awareness of energy costs as will regular communication of that information to your staff. How these costs are communicated can make the difference between a person being only mildly interested in saving energy or highly motivated to take an active role in energy management.

School districts communicate site energy use in several ways:

- sending the site administrator copies of the school's monthly energy bills
- distributing a form that indicates the latest month's energy use compared to the same month of the previous year
- circulating a monthly energy newsletter that describes district energy accomplishments and reports some of the interesting energy activities at individual schools

The following section discusses how school districts communicate site energy use to their site administrators and staff.



Some Practical Tips...

1. Know Your Audience

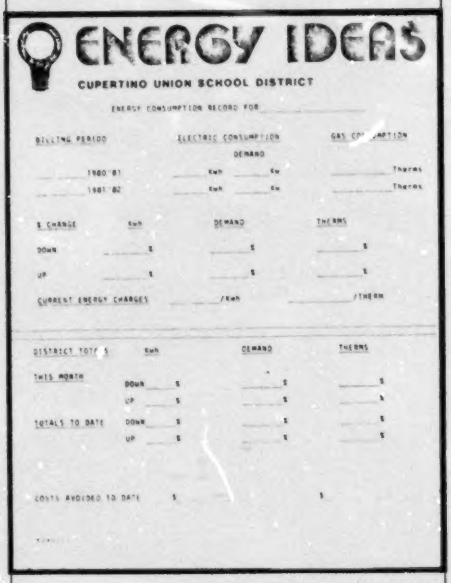
As has already been discussed, the composition and needs of your audience probably account for your most critical and complex decisions. From the same set of data, a number of reports will be developed and distributed to a wide variety of audiences—your board, superintendent, district energy committee, principal, site energy committee, school staff, students, parents, possibly the funding agency that sponsored your program, your utility, the press, and others. If your energy savings are significant, you can use your reports as a public relations tool to show how wisely the district uses taxpayers' money.

After identifying each "audience" to whom you report, develop a listing of what information they will need to make whatever decisions are within their authority. Different audiences may need different information, even to answer the same question. It may help to discuss the format with the audience before it is developed. They may or may not be interested in the level of detail on the master sheets you use to collect your data. The information from your master sheets can be condensed as noted below.

- An *At-A-Glance Comparison* chart or graph compares last month's energy usage to the same month last year or in the base line year without relying on numbers, but instead on

visuals. It reflects how effectively the program is "paying off" and lets you know quickly if you are doing better or worse. It can be presented on a yearly basis as well and is derived from the monthly consumption record.

- A *Summary of Energy Usage* presents consumption data and the corresponding cost avoidance or $ per student—whatever statistics you select as most relevant. Such a summary should provide only one or two numbers per site to avoid confusion. It may be presented in memo form as well with a substantial narrative and summarize data for the entire district. If it is broken out by site, the individual schools may be interested in seeing how they are doing in comparison to others.
- *Monthly Consumption Records* for each site indicating both kilowatt and therm usage, cost for energy, and other comparisons such as $/student are designed for principals and their respective energy committees or student energy commissions. They may be the same forms that the energy manager at the district uses to track district usage, but when used on site, they have another function—input for fine-tuning an on-site program. Schools may be interested in the summary of data from other schools as noted above.


ENERGY IDEAS

CUPERTINO UNION SCHOOL DISTRICT

ENERGY CONSUMPTION RECORD FOR _____

BILLING PERIOD	ELECTRIC CONSUMPTION		GAS CONSUMPTION
	DEMAND		
1980-81	Kwh	Kw	Therms
1981-82	Kwh	Kw	Therms

$ CHANGE	Kwh	DEMAND	THERMS
DOWN	$	$	$
UP	$	$	$
CURRENT ENERGY CHARGES	/Kwh		/THERM

DISTRICT TOT'S	Kwh	DEMAND	THERMS
THIS MONTH DOWN	$	$	$
UP	$	$	$
TOTALS TO DATE DOWN	$	$	$
UP	$	$	$
COSTS AVOIDED TO DATE	$		$

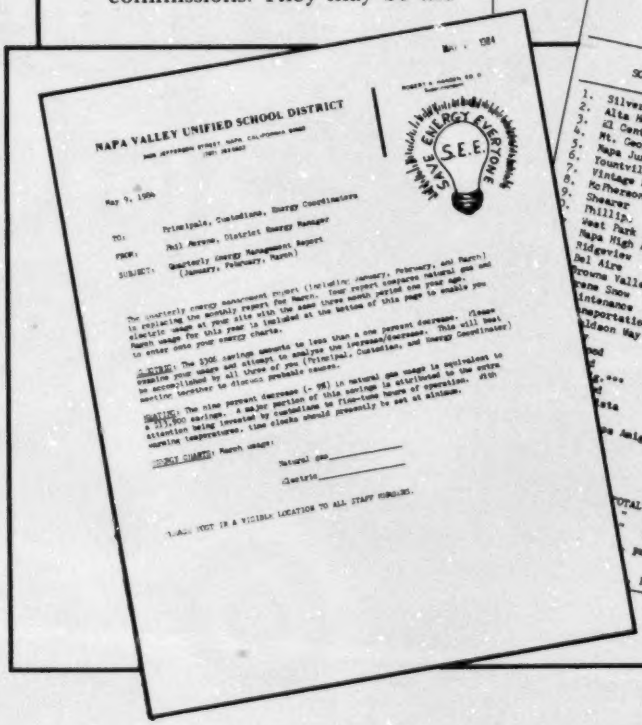
2. Generate Awareness at each School

Teachers frequently complain that they spend too much time in meetings. To report information to teachers you might:

- distribute the information in a memo or chart
- put the information in the school bulletin
- post the information on a bulletin board in the staff room
- provide the information quickly during a regularly scheduled faculty, grade level or subject area meeting
- meet with one teacher per grade or school and ask them to tell the others
- ask teachers to decide on the most convenient time to meet

3. Recognize Outstanding Cooperation and Achievements

Communicating monthly energy data in positive or novel ways has worked well for several districts. In the Napa Valley Unified School District, this step is seen as a cornerstone in a 10-step program. You can:


NAPA VALLEY UNIFIED SCHOOL DISTRICT

May 9, 1984

TO: Principals, Custodians, Energy Coordinators

FROM: Phil Arrowe, District Energy Manager

SUBJECT: Quarterly Energy Management Report (January, February, March)

SAVE ENERGY EVERYONE S.E.E.

The quarterly energy assessment project (including January, February, and March) is replacing the monthly report for March. Your report compares natural gas and electric usage at your site with the same three month period one year ago. Each month usage for this year is included at the bottom of this page to enable you to enter onto your energy charts.

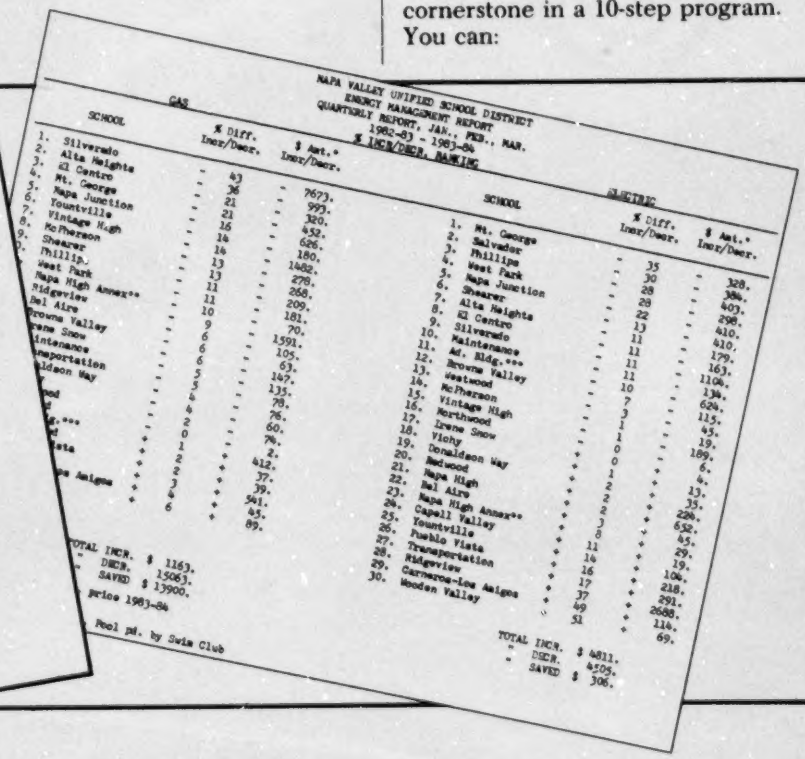
A NOTE: The $300 savings amounts to less than a one percent decrease. Please examine your usage and attempt, in analyzing the increase/decrease. This will best be accomplished by all three of you (Principal, Custodian, and Energy Coordinator) meeting together to discuss probable causes.

CHARTS: The nine percent decrease (- 9%) in natural gas usage is equivalent to $ 17,000 savings. A major portion of this savings is attributed to the extra attention being invested by custodians to fine-tune hours of operation, night cycling temperatures, time clocks should presently be set at minimum.

ENERGY CHARTS: Month usage:

Natural gas _____

Electric _____


NAPA VALLEY UNIFIED SCHOOL DISTRICT
ENERGY MANAGEMENT REPORT
QUARTERLY REPORT, JAN., FEB., MAR.
1982-83 - 1983-84
$ INCR/DECR. RANKING

	GAS SCHOOL	GAS % Diff. Incr/Decr.	GAS $ Amt.* Incr/Decr.	ELECTRIC SCHOOL	ELECTRIC % Diff. Incr/Decr.	ELECTRIC $ Amt.* Incr/Decr.
1.	Silverado	- 43	- 7673.	Mt. George	- 35	- 328.
2.	Alta Heights	- 36	- 999.	Salvador	- 30	- 384.
3.	El Centro	- 21	- 320.	Phillips	- 28	- 407.
4.	Mt. George	- 16	- 452.	West Park	- 28	- 298.
5.	Napa Junction	- 14	- 626.	Napa Junction	- 22	- 410.
6.	Yountville	- 14	- 180.	Shearer	- 13	- 410.
7.	Vintage High	- 13	- 1482.	Alta Heights	- 11	- 179.
8.	McPherson	- 11	- 278.	El Centro	- 11	- 163.
9.	Shearer	- 11	- 268.	Silverado	- 11	- 1106.
10.	Phillips	- 10	- 209.	Maintenance	- 11	- 134.
11.	West Park	- 9	- 181.	Ad. Bldg.**	- 10	- 629.
12.	Napa High Annex**	- 6	- 70.	Browne Valley	- 7	- 115.
13.	Ridgeview	- 6	- 1591.	Westwood	- 3	- 45.
14.	Bel Aire	- 6	- 105.	McPherson	- 1	- 19.
15.	Browne Valley	- 5	- 63.	Vintage High	- 1	- 189.
16.	Irene Snow	- 5	- 147.	Northwood	0	- 6.
17.	Maintenance	- 4	- 135.	Irene Snow	+ 1	- 4.
18.	Transportation	- 2	- 78.	Vichy	+ 1	- 13.
19.	Donaldson Way	0	- 60.	Donaldson Way	+ 2	- 35.
20.	Redwood	+ 1	- 76.	Redwood	+ 2	- 226.
21.	Napa High	+ 2	- 2.	Napa High	+ 2	- 652.
22.	Bel Aire	+ 2	+ 412.	Bel Aire	+ 3	- 45.
23.	Napa High Annex**	+ 3	+ 37.	Napa High Annex**	+ 3	- 29.
24.	Capell Valley	+ 4	+ 79.	Capell Valley	+ 3	- 19.
25.	Yountville	+ 6	+ 541.	Yountville	+ 8	- 106.
26.	Pueblo Vista		+ 45.	Pueblo Vista	+ 11	- 218.
27.	Transportation		+ 89.	Transportation	+ 14	- 293.
28.	Ridgeview			Ridgeview	+ 16	- 2688.
29.	Carneros-Los Amigos			Carneros-Los Amigos	+ 17	- 116.
30.	Wooden Valley			Wooden Valley	+ 37	- 69.
					+ 49	
					+ 51	

TOTAL INCR. $ 1163.
" DECR. 15063.
SAVED $ 13900.
prior 1983-84

Pool pd. by Swim Club

TOTAL INCR. $ 4811.
" DECR. 4509.
SAVED $ 306.

- provide "goodies" (Napa has their Food Service deliver hot rolls and in El Dorado County it's doughnuts), if staff meet energy management goals. Post the energy data next to the goodies to encourage support for energy saving actions. It may seem silly, but it works!
- hold a contest for students and staff to guess how many kWh and therms or dollars are spent in a month. Cost figures make quite an impression on kids. Be sure to have a prize that students are interested in and another prize staff would like.
- hold a contest to select an energy mascot, particularly at primary or elementary schools. If the school reduces energy use by 10%, they get to fly a flag with their mascot for all to see. This type of program was successfully sponsored by Southern California Edison with ConservaCat as the mascot featured on the flag.
- host an honorary luncheon for school staff in schools that achieved outstanding energy savings. Napa Valley USD found that having school board members present to express their "thank you" was important.

4. Convey Information for School Board Decisions

School board meetings often have a full agenda. Make your item simple to act on by restating the decision under consideration and summarizing the relevant information for them in an easily understandable packet. It can be distributed beforehand but should cover all the basics and enough of the non-essentials to make it interesting, but not overwhelming. If you expect the audience to absorb the information, do not confuse the issue by overwhelming them with other interesting but not necessarily vital information and charts. Remember, the audience may be intimidated by numbers or bored to death by them.

First, Get Their Attention...

SECOND, EXPLAIN YOUR CASE. FOR BEST RESULTS, DO BOTH AT ONCE.

You may or may not have a choice in how you present your information. Even if you present it verbally, in person, it's helpful to leave your audience with something written that summarizes your message as noted above. The points presented below apply to memos, news releases, written reports, informal and formal oral presentations.

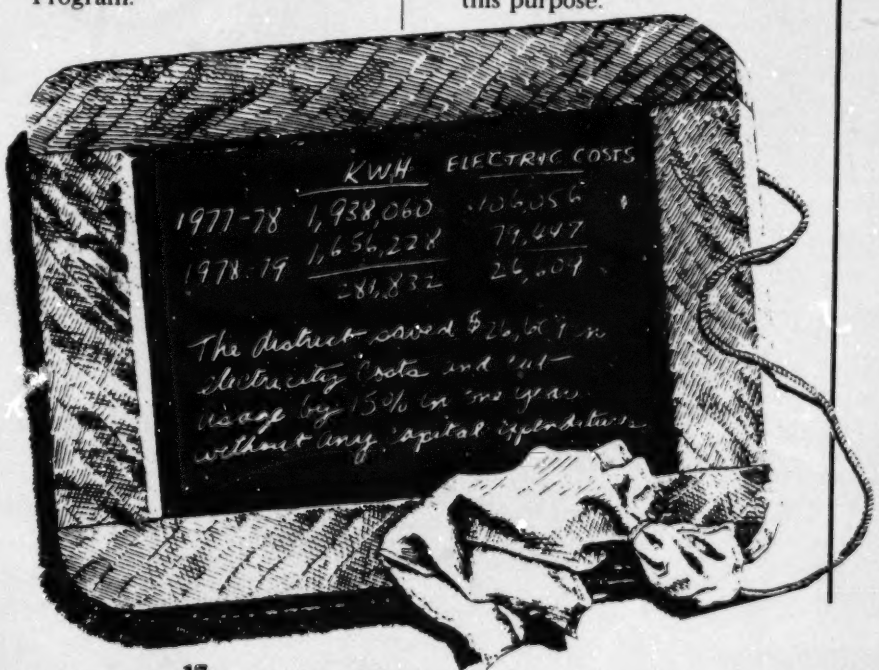
1. Use graphic artist's techniques to spark interest

- Use descriptive headings or "newspaper" headlines to spark interest and seduce the reader into reading your report. Note how you are affected by these headlines—"Teacher Attitudes," "Teacher Attitudes Toward the Program," and "Teachers Favor Program."

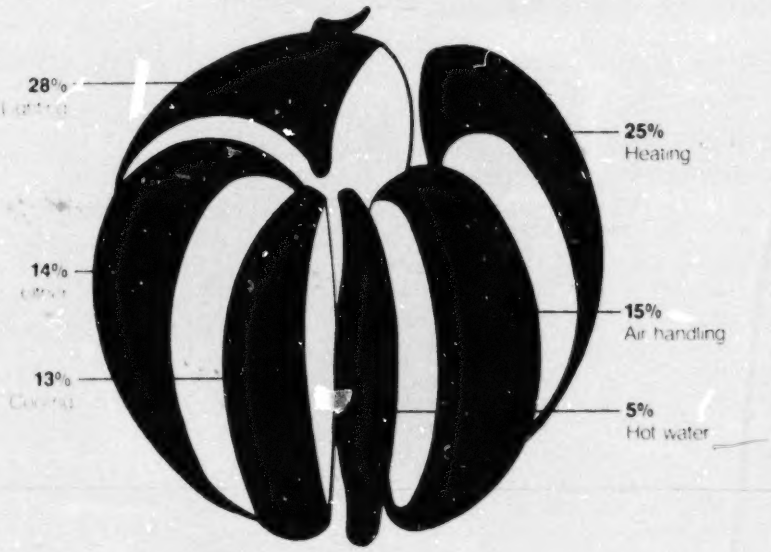
School		Sept.	Oct.
Pearmer	1979-80	None	4.72%
	1980-81	None	None
	1981-82	None	15.3%
Dingle	1979-80	None	11.73%
	1980-81	None	18.11%
	1981-82	None	20.9%
Freeman	1979-80	None	None
	1980-81	None	5.00%
	1981-82	6.7%	19.0%
Gibson	1979-80	None	None
	1980-81	None	00.08%
	1981-82	None	18.5%
Grafton	1979-80	8.05%	15.55%
	1980-81	17.24%	14.52%
	1981-82	None	1.3%
Laugenour	1979-80	58.73% **	7.94%
	1980-81	55.55%	7.94%
	1981-82	None	None
Marin	1979-80	7.60%	49.02% **
	1980-81	13.40%	14.95%
	1981-82	None	5.0%

Those schools "boxed" on this annual kWh reduction chart from Woodland Joint USD received $200 awards for the greatest percentage reduction in a given month.

- Format your report in an outline form with dots and more white space (as this section is done). Use boxes around important points. Change your typeface and use underlining or CAPITAL LETTERS.
- Pay attention to lettering. Graphic artists use hand lettering, rub-on letters, stamps, KROY machines, calligraphy and the typewriter.
- Add pictures and graphics to make your report stand out from others. Books of copyright-free clip art or stamps are available for just this purpose.


KWH ELECTRIC COSTS
1977-78 1,938,060 106,056
1978-79 1,636,228 79,447
-281,832 26,609
The district saved $26,609 in electricity costs and cut usage by 15% in one year without any capital expenditures

A Typical School's Energy Consumption



- Use different colors to highlight certain items. For example, a graph can be developed for base line energy use. You can cover it with transparent overlay sheets and plot usage by year with different color grease pencils.
- Avoid technical terms and jargon that may alienate your audience. Search for the simplest words, and if technical jargon is necessary, define your terms before someone has to ask.
- Use active verbs whenever possible. They tend to shorten sentences and increase the impact.

PASSIVE EXAMPLE:
The energy use of the classes participating in the program was lower than that of classes in the control group. (20 words)

ACTIVE EXAMPLE:
Classes in program used less energy than those not participating. (10 words)

- Personalize the text to make it less formal. This depends upon your audience, but personal pronouns such as I and we, contractions, and colloquial language are showing up more and more in technical reports.

2. Start with the most important information

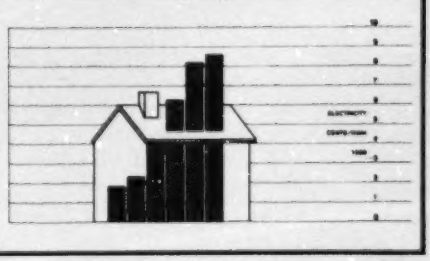
Imagine that your reader will not have time to get through your entire report or that your listener may leave early. Keep it simple, short and direct. Since it is likely that both your written and verbal presentations will be interrupted, you must make your point early. Here again begin with a summary. In an oral presentation, you can accomplish this with a large and simple visual aid that will accompany your presentation. By posting this before you begin, your audience may have a chance to read your chart before you speak. Be sure that neither the summary nor the chart are full of numbers. Make it big enough to be read from a distance.

3. Make the presentation interesting and varied

- This is particularly important for verbal presentations. They should have enough variety to entertain the audience. Almost anything you can do to keep their attention is warranted.

Do something different than what the audience is used to. Some novel formats include skits involving students, panel discussions, question and answer sessions and audiovisuals with commentary.

- Vary the format within your presentation. Five minutes of lecture, followed by four minutes of slides, four minutes of questions and answers and one final minute of summary lecture is probably more interesting than fourteen minutes of lecture.
- Shift the focus of the presentation to different points in the room. When talking about the impact of delamping, you might walk over to the light switch and turn half of the lights off. The audience will follow you and be more interested in what you have to say. You'll be sure to wake up those who may have mentally drifted off!
- Use visuals to summarize your important points. They can include graphs, photographs, numbers, cartoons, quotations, drawings and text. Be sure the person farthest away will be able to read your visual clearly. Don't use a visual that you must apologize for!



Graphs and Tables that Work

"It is sometimes said that the facts speak for themselves. In reality, statistics often stand speechless and silent, tables are sometimes tongue-tied and only the graph cries aloud its message."

When presenting energy use data, it is almost impossible to get away from tables or graphs. They are the clearest way to get your message across. They provide a summary for your written report and the visuals for a verbal one. For each decision to be made, develop tables or graphs that address that specific issue. People leafing through reports usually pause to examine graphs. Some of your readers will only look at the graphs, so they must be self-explanatory and understandable out of context. Usually, graphs are prepared to accommodate both base line and current year usage. Separate graphs are often appropriate for each energy source. Whether you generate your report manually, or by computer, the following pointers will apply.

TABLE 2

Average Annual kWh Use Before and After Energy Patrol Program for Schools in Escuela District

School	KWH May 1980[a]	KWH May 1981[b]	KWH Diff.	% Diff.	Cost Avoidance
Del Oro	19,546	10,987	8,559	44	$ 599.13
Las Lomas	9,480	8,760	720	8	$ 50.40
Miramar	26,260	8,760	17,400	67	$1,218.00
Montana	13,332	6,237	7,095	53	$ 496.65

[a] school year before program was initiated.
[b] school year after program has been in operation one year.

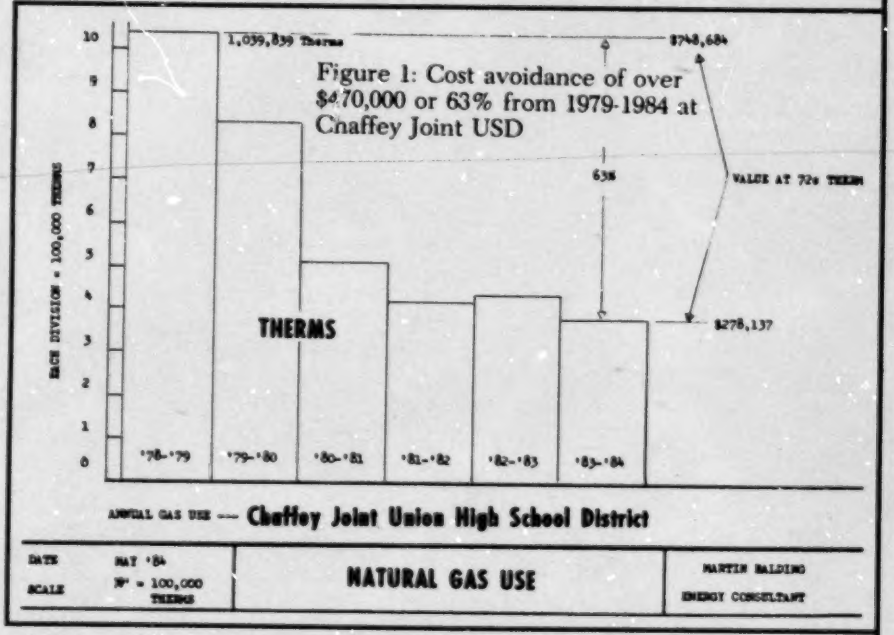


Figure 1: Cost avoidance of over $470,000 or 63% from 1979-1984 at Chaffey Joint USD

Tables

It is standard practice to show footnotes alphabetically in tables, using asterisks for indicating statistical significance. The caption describing a table always appears above it, with the word TABLE completely capitalized. The first letter of each important word in the caption is capitalized as well.

TABLE 1

Cost Avoidance for Energy Patrol Program for Schools in Escuela District

School	Cost Avoidance
Del Oro	$ 600
Las Lomas	$ 50
Miramar	$1,218
Montana	$ 496

The information in this table could have been presented with symbols or simplified even though some of the details would be lost. The message— energy patrols save money—would be even clearer and might be appropriate when a decision about expanding the program to other sites is under consideration. If you are including rebates as an incentive for participation, Table 2 is particularly appropriate. It easily shows "Miramar" as the overall winner. You could list schools in order of cost avoidance instead of alphabetical. In the Napa Valley monthly energy report highlighted earlier, Tables like 1 and 2 are both presented in each report so that it meets the needs of more than one audience.

Bar Graphs

Bar graphs are common in energy data reports—and for good reason. They are easy to understand.

Note that graphs are called "Figure" when labeled and referred to in text. The caption appears below the graph and the first word of the caption is capitalized. A key is provided to

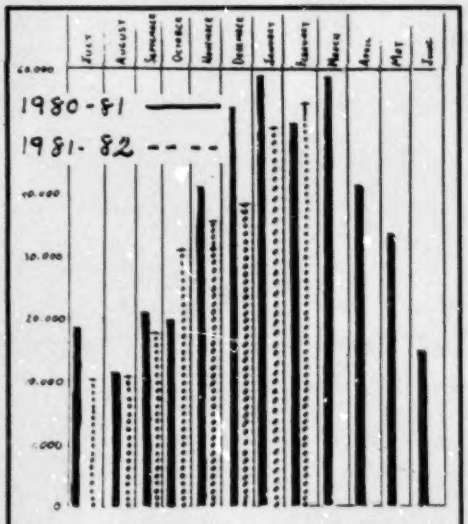
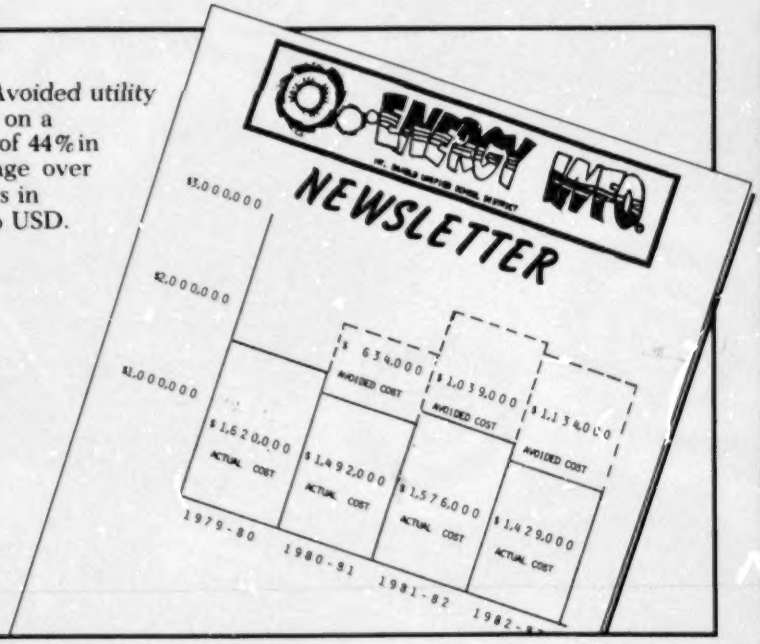


Figure 2: Monthly gas consumption over a two year period in Acalanes UHSD.

Figure 5: Avoided utility cost based on a reduction of 44% in energy usage over three years in Mt. Diablo USD.



explain the graph. To provide precise information, the actual energy use figures would be shown above the bars in the graph.

Figure 2 displays gas usage and cost for an entire year in Acalanes Union High School District by using two bars, one shaded and one dotted. This graph makes it easy to monitor monthly use and give special attention to conservation in high use months. The same information can be presented with shadow bars as in Figure 3, which is particularly effective for displaying "before" and "after."

Figures 4 and 5 show two methods for graphing program results. With Figure 4, an objective can be shown as a horizontal line or a divided bar. You can readily see from the figure that the goal was not reached by all but was exceeded by more than half of the schools for gas reduction. The divided bar has been particularly effective for demonstrating avoided cost in Mt. Diablo USD and has been used frequently as a visual for oral presentations.

By placing the bar graph sideways, you can type labels inside the bars (as in Figure 6) if you have more

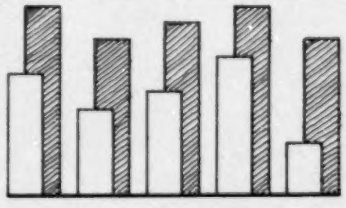


Figure 3: Monthly gas consumption before the district program and after the district program.

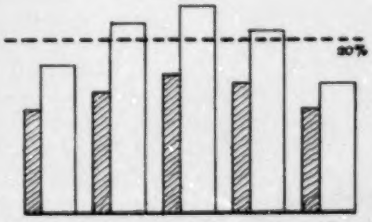


Figure 4: Progress of schools in meeting program objective of twenty percent savings.

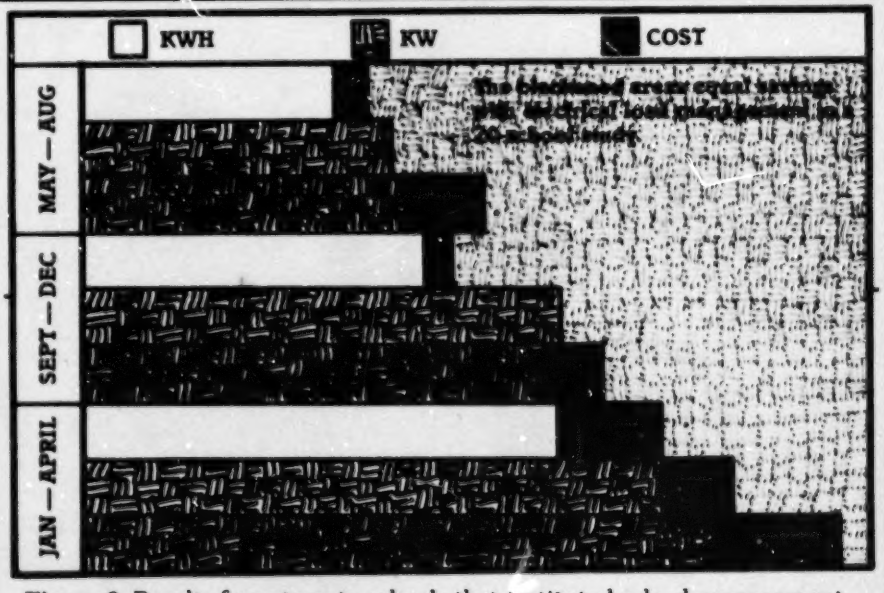
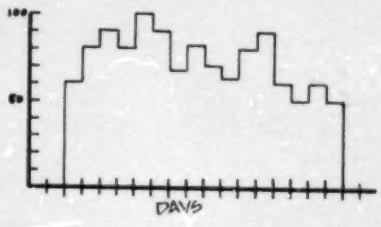


Figure 6: Results from twenty schools that instituted a load management program to defer or shift energy use without reducing comfort or service.

Figure 7



information than can fit. In the Mt. Diablo example above, this wasn't necessary. Note as well the use of a different type of shading in the figure.

Figure 7 is a bar graph but without the vertical lines dividing the bars. It closely resembles a line graph.

Line Graphs

In Figure 8, a line graph is used to replace a bar graph. It is useful when the horizontal axis represents a measure that has a natural sequence, such as time, scores or energy use. In contrast to a bar graph, a line graph is used to show a relationship between points on the graph. It is particularly effective for showing the results of two or more schools over the same time period, energy use per month over two consecutive years, or electricity and gas use over the same period.

A line graph can be useful in

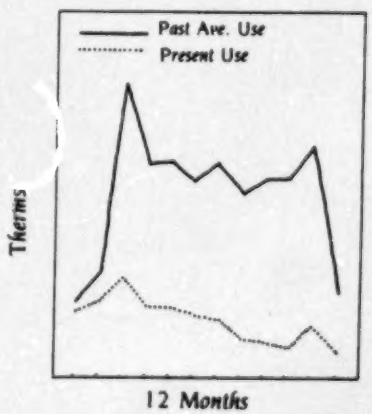
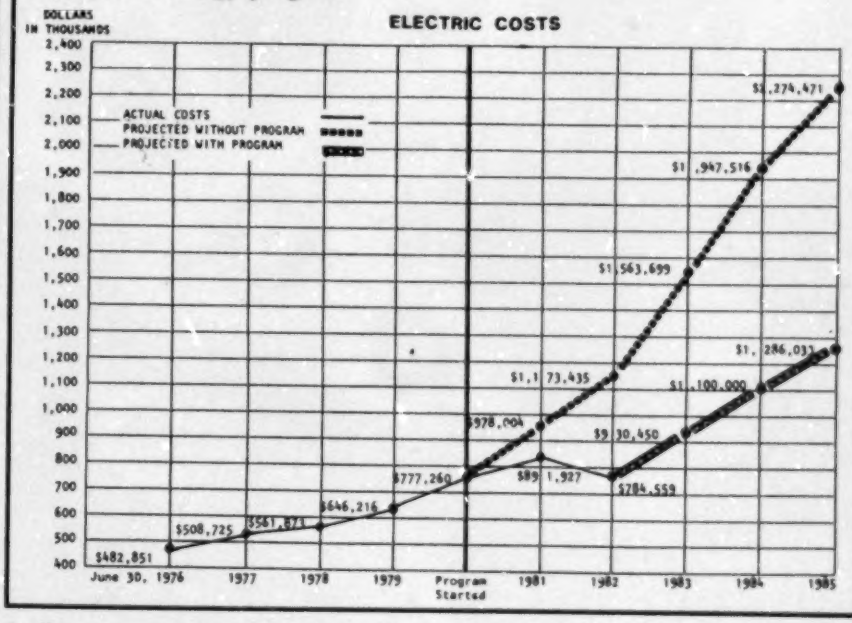


Figure 8: Decrease in natural gas use at Alta Loma High School

Figure 9: Projected electric costs for Pomona USD with and without proposed energy program.



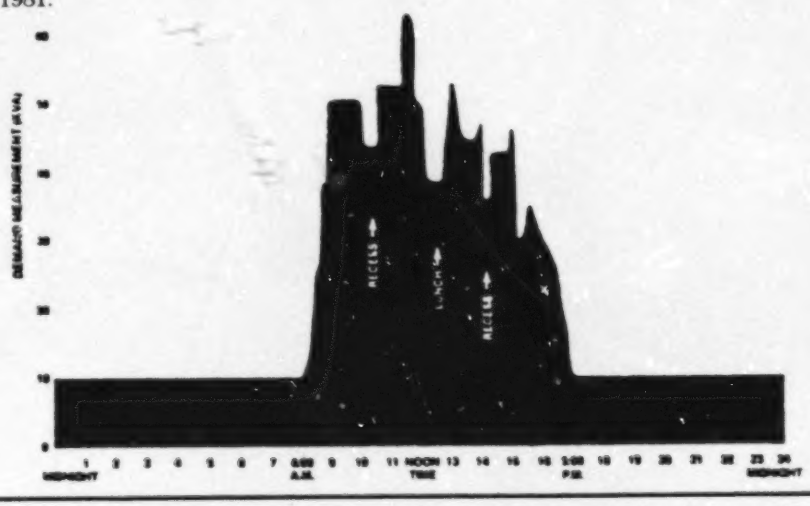
"selling" a program. The attached graph, Figure 9, summarizes the information gathered by the staff for the Pomona Unified School District during their planning for their Energy Management and Conservation Program. This excerpt from their report "Energy Perception: Priority for the Future," explains how it was developed.

"Under the direction of the Business Services Department, the staff undertook a comprehensive analysis of all energy usage throughout the Pomona Unified School District. This analysis included a complete examination of consumption at each one of the district's 37 sites as well as lengthy conversations with all utility companies serving the district.

"The analysis showed an alarming increase in the total commitment of district funding to utility costs. Energy costs are rapidly becoming a major expenditure in our District's budget. Last year, we spent $647,338.00 on electricity and $242,483.00 on natural gas. For the most part, the District's usage has remained constant for the past three years while cost has increased by approximately 60%. Assuming electricity costs rise at a similar rate, we will have to budget $1,805,742.00 a year for electricity. This makes for an energy budget of $2,572,514.00, a 189% increase over 1978-79."

Line graphs are useful for showing demand as well as kWh usage. Although the set of data presented for the Andrew Sibbald School in Figure 10 is unique, it clearly illustrates that the changing use patterns in a school do appear as high and low energy demand times. If your school is not in session in July and August, demand readings should be significantly lower than in May or June when school is in full operation. It shows that the electrical demands of classrooms, staff rooms, gymnasium and halls really do add up to form the majority of the demand placed on the electric meter—and your electricity bill! Stadium lights on for four hours, one day per week can have a drastic impact on your bills. The greatest use obviously is during school hours--from 9 a.m. to 3:30 p.m. If there are activities which cannot be switched to other times of the day, lighting practices can lower demand. Turning off the lights at recess and during lunch

Figure 10: Energy demand profile for Andrew Sibbald School on June 5, 1981.

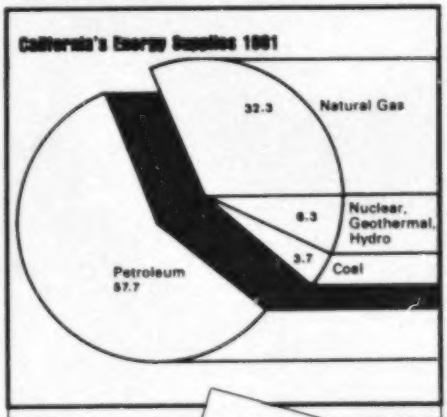


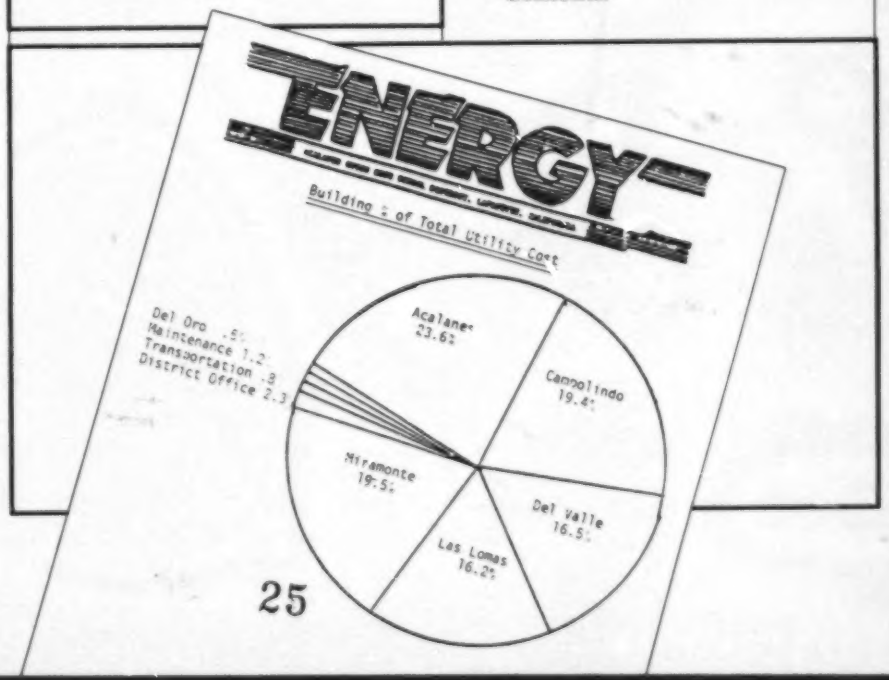
hour, which is what the Energy Patrol does, will have an effect. (The Energy Patrol is described in the CEES publication "How To Motivate Staff and Students.")

At another school in Alberta, an inspection of the electrical demand meter revealed that at some points in the day, the total power drawn by the lights, fans, pumps, and pottery kiln was as high as 120 kilowatts. This always happened between 10 a.m. and 2 p.m. when everything was turned on. Most utilities charge schools a demand billing based on the maximum kw use in a given period. (See APPENDIX B). When it was demonstrated to the teacher using the kiln that operating it at night (thereby reducing the peak demand), would save about $720 per year on the demand charges of the electrical bill, he quickly obliged.

Pie Charts

A pie chart may also be used to replace a bar graph. It is particularly effective for comparing the parts of a whole or percentages. Note how Acalanes has used them to show the total energy use of the district broken down by school. The pie chart concept can be made more interesting by adding perspective to form a cylinder or using a more complex form such as an apple instead of the circle. Pie charts are a visual way of comparing the same information presented in a table.





PRESENTING DATA VISUALLY: A SUMMARY

1. Get their attention by using graphic methods for presenting numerical data whenever possible.
2. Select the type of graph that best presents the data needed to make a particular point.
3. Explain your case around the graphs, not the other way around.
4. Make each graph or table self-explanatory. Use a clear, complete title, key, labels, footnotes, etc.
5. Repeat in your text the major information found in each table or figure. Keep it short, simple and direct.
6. For each completed figure or table, ask yourself:

- Could someone leafing through the report understand the figure(s)?
- Are both axes clearly labeled with a name?
- Are the intervals clearly marked on all axes?
- Is the number of cases upon which the figure(s) is based noted?
- Are figures and tables labeled and numbered consistently throughout the report?
- If the report is long, have you provided a List of Tables and Figures following the Table of Contents?

Appendix A:

Reporting Energy Data With Temperature Corrections

As noted in the text, the Educational Facilities Laboratory[4] has established that a linear relationship exists between the amount of fuel used and the number of degree days for elementary and high schools. Therefore, heating fuel (usually natural gas) comparisons which do not take temperature fluctuations into consideration may be misrepresenting energy savings in proportion to the variation of temperatures from one comparison month to the next.[3] This appendix developed by Mark Duerr of Duerr Evaluation Resources will present a temperature corrected method of reporting gas use which allows you to determine the amount of energy that could have been expected to be used. The "expected" value is compared to actual usage to determine energy savings. This method has been used successfully by a number of districts in California.

The temperature corrected method of reporting heating fuel use is based on a mathematical formula which can be easily computed by a calculator. The type of calculator needed is one which is capable of linear regression. Many of these machines sell for less than $40.00. (Some examples are: Texas Instrument 55, Casio FX 3600-P, Sharp 512 and 5103, and others.) The following sections of this paper will outline the steps necessary for any school or district to report temperature corrected gas use results.

1. Collect Temperature Data for Baseline Year

First, you will need the monthly "temperature history" of the baseline year and present year. The specific data you will need is referred to as Heating Degree Days (HDD). A heating degree day is defined as an average daily temperature of one degree below 65°. Therefore, an average daily temperture of 64° would be reported as one HDD, and average temperature of 60° would be five HDD (65°−60° = 5), and so on. The number of heating degree days in a month are summed for a reported Total Monthly HDD's. The more HDD's there are in a month, the colder the month.

HDD data is collected at stations in over one hundred different California locations by the National Climatic Center and is published as a monthly journal: *Climatological Data: California.*[3]

It may prove somewhat difficult to obtain current HDD data for your area since the journal is published about three months after each summrized month. One solution is to locate the station nearest you in the journal and call the station to ask if they will give you the HDD totals for the current month. Another source of current information might be a local National Weather Service station. These are usually located at medium to large airports.[4] One other source might be your local utility company. In Northern California, Pacific Gas & Electric has many sites which report this data. If after you collect the HDD data you find that the one year total of HDD's is 1200 or less, you probably do not need to use this analysis since these relatively few HDD's will not significantly alter heating fuel use measurements.

TABLE 1

Heating and Degree Days and Gas Consumption

MONTH	BASELINE YEAR HDD'S (x)	THERMS USED (y)
July	5	10[illegible]
August	10	110
September	15	150
October	150	300
November	190	350
December	270	550
January	325	700
February	400	900
March	350	700
April	250	300
May	20	150
June	5	100
TOTAL	1890	4410

The relationship between these two variables can be plotted on a graph as noted in Figure A. Each point represents this relationship for one month.

2. Chart Temperature and Gas Use Data for Baseline Year

When the information on therms used in the baseline year is collected, enter it in a chart (as shown in Table 1) along with the

baseline year HDD's. Be sure that the number of days during a given month corresponds to the utility billing period. Billing periods in one year can vary by as many as six days out of 30, or twenty percent. Or, a meter may not be read as scheduled, misread or incorrectly recorded. In either of these cases, a bill for a very small amount of energy may be received followed by the next months' bill that includes a portion of the first months' usage with the second. To correct this, you may simply need to divide the usage using your best judgement.[5]

The relationship between these two variables can be plotted on a graph as noted in Figure A. Each point represents this relationship for one month.

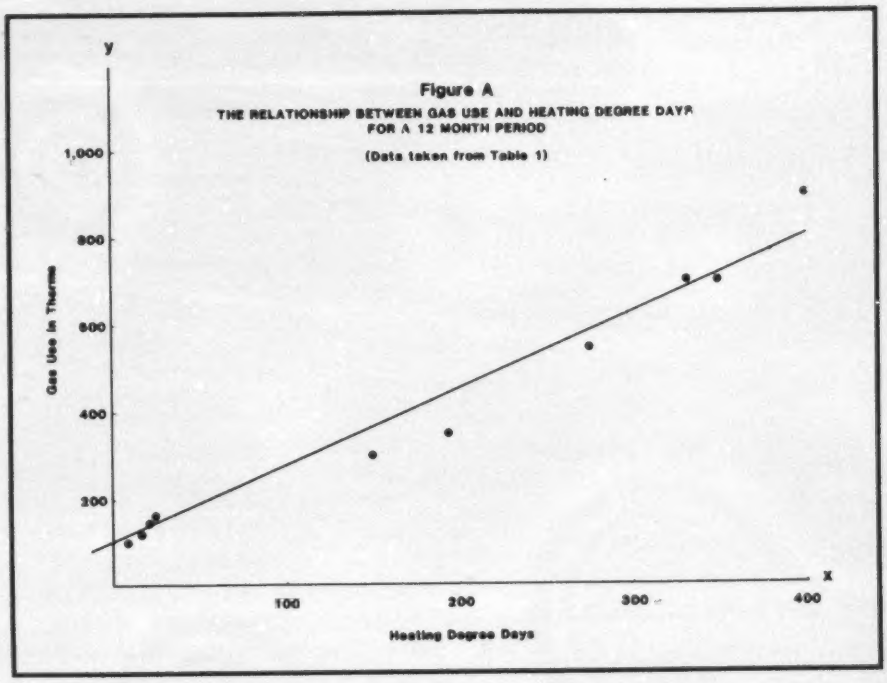


Figure A
THE RELATIONSHIP BETWEEN GAS USE AND HEATING DEGREE DAYS FOR A 12 MONTH PERIOD
(Data taken from Table 1)

The display of all these points can be mathematically described through linear regression, the process of "best fitting" a straight line through the set of points. All lines follow the formula "y = a + bx", where y and x are the two variables and a and b represent constants, calculated through linear regression to help describe the line. More specifically, b equals the slope of the line and a equals the place where the line intercepts the y-axis. This relationship is shown by the line drawn through the points in Figure A.

3. Establish a Formula For Expected Gas Use

Now you are ready to calculate a theoretical, or *expected*, gas use for the present period based on the data collected. This ability is important for determining the energy savings resulting from an energy management program. You will use the calculator to determine how much gas you would *expect* to use based on past and current temperature data. Since the expected use will be extracted from the baseline year data (i.e. a period w.en you did not have an energy conservation program), and you will have corrected for current temperature changes, then any difference between the present period *expected* gas use figure and present period *actual* gas use will be due solely to your energy management program as shown in Figure B.

To summarize: Use the baseline period HDD and gas use data *plus* current period HDD data to calculate an *expected* gas use. In formula form, it looks like this:

Present period expected gas use = a + b (present HDD)

You will use the calculator and the baseline year data to calculate the terms a and b.
Enter the baseline year HDD's and therms into the calculator in the following way:

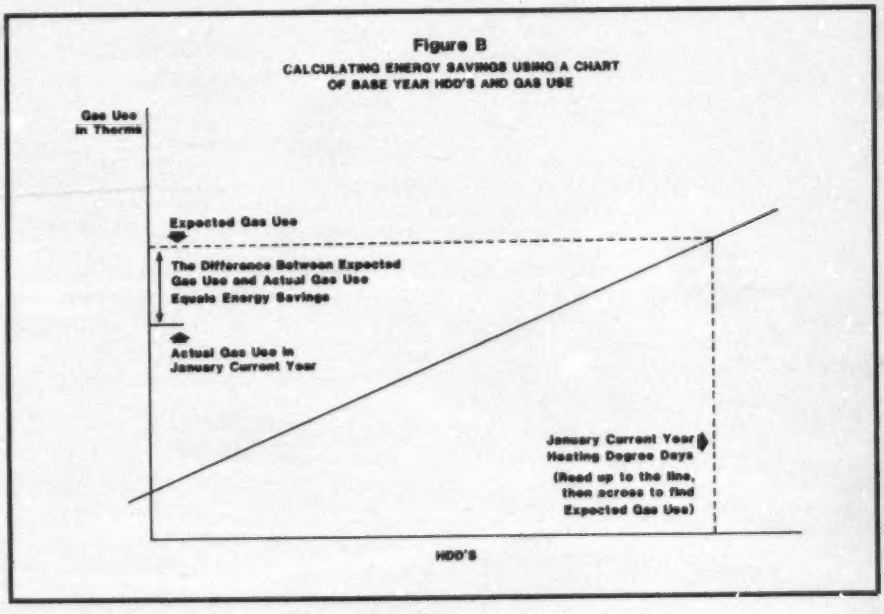

Gas Use in Therms
Expected Gas Use
The Difference Between Expected Gas Use and Actual Gas Use Equals Energy Savings
Actual Gas Use in January Current Year
January Current Year Heating Degree Days
(Read up to the line, then across to find Expected Gas Use)
HDD'S

Figure B
CALCULATING ENERGY SAVINGS USING A CHART OF BASE YEAR HDD'S AND GAS USE

Enter month 1 HDD's and push the x≷y key

Enter month 1 Therms and push the Σx key

Enter month 2 HDD and push the x≷y key

Enter month 2 Therms and push the Σx key

and so on until all the baseline year numbers are entered. Then push the intercept key. The number on the calculator register is the term *a*. Then push the slope key to get *b*.[6]

You now have the values for a and b. In our example, the HDD for October is 150 and the gas use 300. Thus,

a = 78.3

b = 1.84

Again, using the formula for present period expected gas use, you now have:

Present period expected gas use = a + b (present HDD) = 78.3 + 1.84 (present HDD). At this point you can also calculate the correlation coefficent. This number represents the strength of the relationship between HDD's and fuel use, where 1.00 is a perfect (desirable) relationship and .00 is lowest. Your calculator guidebook will show you how to obtain the correlation. If your correlation is below .80, you *may* decide not to use the HDD model since the relationship is weak. If the correlation is below .60, the model should *not* be used.

Now all you need is the present period HDD's. For our example, let's say that you want to know the expected gas use for October in the present year. October this year had 260 HDD's. The formula is now complete:

Present period expected gas use (October) = 78.3 + 1.84 (260) = 557 therms

The formula states that given the baseline year data (a = 78.3 and b = 1.84) and the current month HDD's (260), you should expect to have used 557 therms of gas this October. The increase in gas use from an expected 557 therms in the current month vs. 300 therms actually used last October is expected because it was *colder* this October. The formula simply tells you *how much* more gas you should expect to use as a result of the colder temperature.

TABLE 2
Temperature Corrected Gas Use

MONTH	BASELINE YEAR HDD'S	BASELINE YEAR THERMS USED	PRESENT YEAR HDD	PRESENT YEAR EXPECTED THERMS	PRESENT YEAR ACTUAL THERMS	THERMS SAVED EXPECTED - ACTUAL	COST PER THERM	COST AVOIDED
July	5	100						
August	10	110						
September	15	150						
October	150	300	260	557	457	100	.50	$50
November	190	350						
December	270	550						
January	325	700						
February	400	900						
March	350	700						
April	150	300						
May	20	150						
June	5	100						

4. Determine Therms Saved

The final task is simply to compare expected October gas use (557 therms) to *actual* October gas consumption. Actual gas use was 457 therms this October. You would show a gas *savings* of 100 therms (expected use of 557 minus actual use of 457 = 100). You can attribute the savings of 100 therms to the energy management program since you have corrected for temperature changes between last October and this October. Note that if you had simply compared last October's therms used (300 therms) to this October's actual therms used (457 therms), you would have incorrectly presented this year's gas usage as an increase of 157 therms (last year's actual 300 therms used minus this year's actual 457 therms used = 157 therm increase).

5. Presenting Temperature Corrected Data and Cost Avoidance

Table 2 is an extension of Table 1. The data from Table 1 is included, along with several other items. This table can be used to collect data (instead of Table 1, if you wish) and to present the results of the temperature correction formula. The only remaining calculation is cost avoidance. Cost avoidance is calculated by multiplying the number of therms saved by the cost per therm. Therms saved is calculated by subtracting actual therms used from expected usage. Then record the present cost of therms. It should be noted that it is possible to get a negative cost avoidance if your expected gas use was *lower* than your actual use. When you sum the cost avoidance column for a yearly total, be sure to include these negative numbers by subtracting them from the total. A negative cost avoidance is a cost increase, an increase *over* what would have been spent if you stayed at the baseline level of use.

References and Notes

1. "Energy Conservation in Schools: A Report on the Development of a Public School Energy Conservation Service," Educational Facilities Laboratories contract FEA C-04-50047-00, October 1975.
2. The use of cooling degree days, CDD, to estimate the energy needed for cooling a building does not give satisfactory results, nor does "equivalent full-load hours" of operating cooling equipment. For a full discussion of this problem, see ASHRAE-76: "System Handbook", Chapter 43, American Society of Heating, Refrigerating and Air Conditioning Engineers, New York, 1976.
3. The National Climatic Center publishes *Climatological Data: California* once a month. Most large public libraries will have copies going back several years. The reference number is: DOC C 55.214.

   To determine the location closest to your school or district, use the map in the back of the journal which shows the location of each station. Once the station nearest you is identified, simply look up the Total Monthly HDD's for that station in the journal. Example 1 shows a sample page from *Climatological Data* which identifies the location of HDD information. (Note: The calculations in this paper are only useful if your average annual HDD's exceed 1,000. This will be the case for most areas of California.)
4. The formula for calculating heating degree days from daily maximum and minimum temperature readings is as follows:

   $$\frac{\text{maximum temp} + \text{minimum temp}}{2} = x;$$

   $65 - x =$ daily heating degree days

   Only answers greater than 0 are used. All nonwhole numbers are rounded downward.

   For example, assume a building's natural gas consumption during January and February 1982 represented 20% of its total 1982 natural gas consumption. If the buildings consumption reduced by 100 therms during the test period January-February 1983, we would project that the total annual savings would equal:

   $$\frac{100 \text{ therms}}{.20} = 500 \text{ therms.}$$

5. For a further discussion on some of the limitations of this analysis and special cases such as all-electric campus or gas absorption chiller, see "Measuring Energy Conservation with Utility Bills," W. Deckel, B. Heitzman, et al., LBL-10114 preprint Berkeley, CA, November 1979.
6. Actual data entry may be slightly different for certain calculators. See calculator instructions for linear regression.

Appendix B:
Translating Utility Bills

The bill provided in this appendix is a sample and may not exactly match your own, particularly if your school is not in the Pacific Gas and Electric service territory. If you have additional questions after reading through this appendix, do not hesitate to contact your local utility.

Before you begin to translate your bill, you will need to know some of the "language" of energy.

- Energy is technically the ability to do work.
- Power is the rate at which that "work" is being done or the instantaneous rate of consumption from the transmission lines.

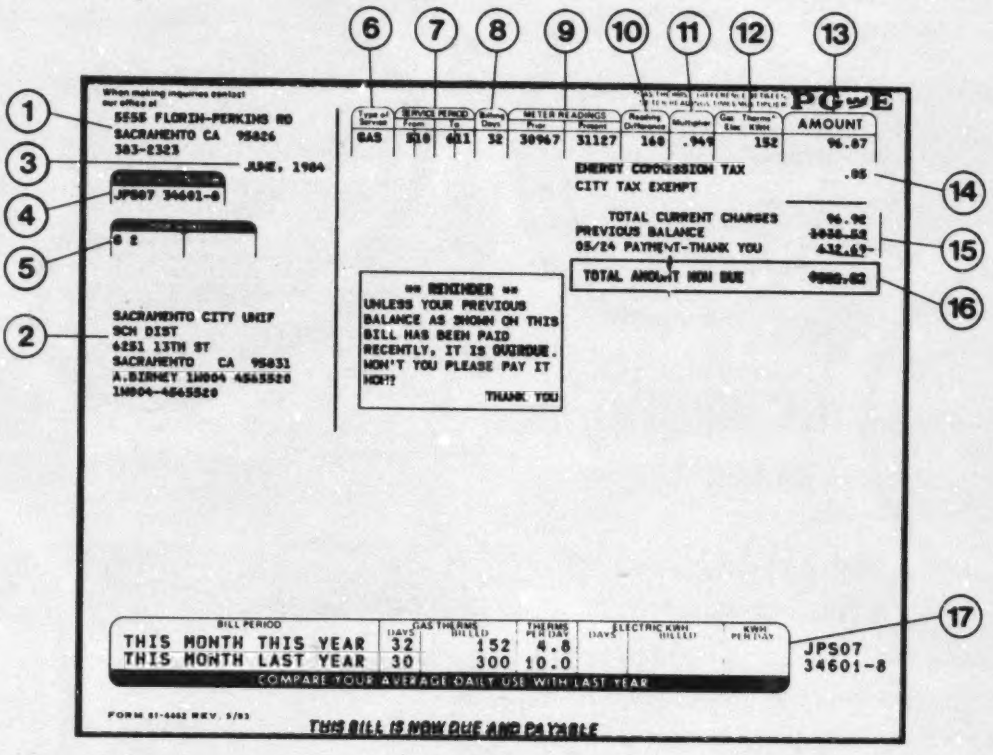
In practice, power or DEMAND is not measured instantaneously, but monitored over an interval of time, usually 15 or 30 minutes. Demand is a measure of the highest amount of power that the facility or, the greatest number of kw consumed in a 15-minute period during the month. Demand billing is a method for equitably distributing the cost of the equipment necessary to generate and distribute the electric power. It can be a significant portion of a school's energy bill. In one district of twenty-four schools, demand charges averaged over 27%of the total electricity bill. For electricity, it is measured in watts, or kilowatts (one thousand watts) by an extra dial on the meter. It operates like a "maximum" measure on a maximum-minimum thermometer and is reset after each reading.

Energy is simply the product of power (kW) and the length of time that the power is being consumed (usually measured in hours). Electric consumption is measured in kilowatt hours (kWh) and is calculated by multiplying the Watt rating of the machine by the number of hours the machine is turned on and dividing by 1000. Electricity costs are then directly related to the amount of time machines requiring electricity are turned on. KWh consumption billing is a method for equitably distributing the cost of fuel and other related costs.

To determine how much those kWh and therms (the unit of measure for gas) are costing the school, you will need to obtain a copy of the relevant rate schedule(s), including the demand schedule. You are not alone if these schedules seem confusing at first. In a 1982 survey, 82% of over 300 districts surveyed agreed that rate schedules were confusing and made it difficult to track and check bills for accuracy. Your account may have both gas and electric (water in some locations) service or you may have separate accounts for each. At PG&E, demand schedules include, but are not limited to A-12, A-21 and A-22. At Southern California Edison, common rate schedules are GS-1, GS-2, TOU-GS, and TOU-8. At the Gas Company, GN-1 and GN-2 are common. Do not hesitate to contact your utility representative if you are confused or wonder whether you are on the most appropriate rate schedule.

Now to the bill itself. The annotations are explained below.

1. Address/telephone number of the local office that serves you. Feel free to call them for assistance, e.g., rate and demand schedules.
2. Your name, service address, and description of building served.
3. Current billing month.
4. Your account number. There may be several for each school.



5. Your rate schedule(s). Your account may have both gas and electric (water in some locations) service or you may have separate accounts for each. A copy of specific charges for each rate schedule is available from your local office.
6. Type of energy provided.
7. Dates of billing period.
8. Number of days in billing period.
9. Actual meter readings for billing period.
10. Difference between meter readings.
11. Multiplier(s):

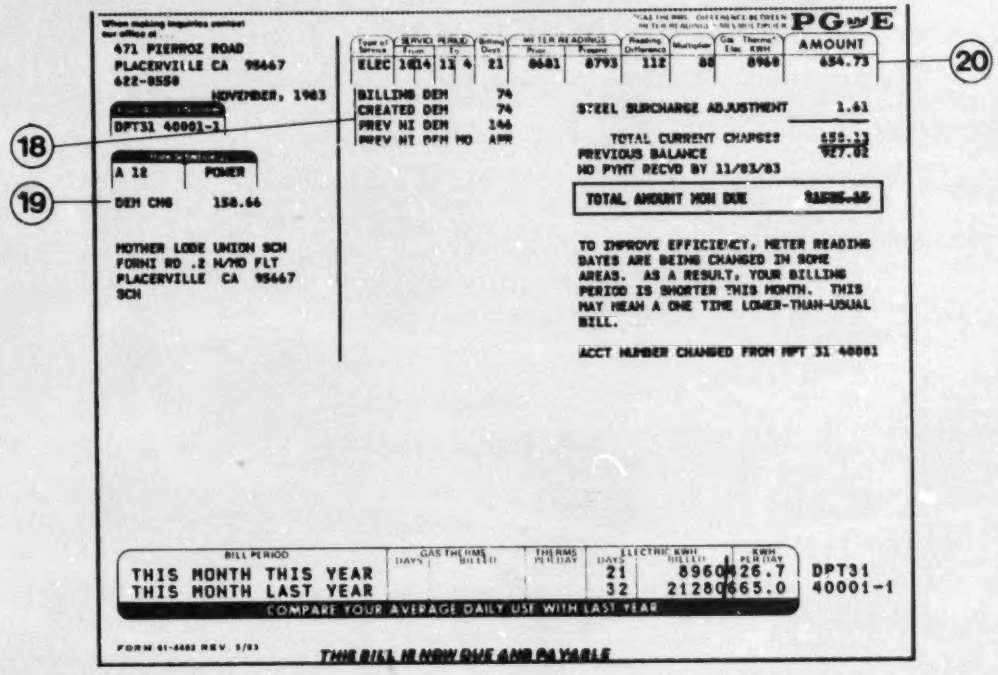
    Gas - You are billed by the amount of heat content (therms) provided in the gas delivered. The gas meter measures the volume of gas delivered, not the heat content. This multiplier converts the volume of gas measured by the meter to the appropriate heating value. The multiplier generally varies slightly each month as there are small changes in the quality of gas obtained by PG&E.

    Electric - If your electric usage is high, only a portion of the total electric energy can be measured by your meter. This multiplier adjusts your meter readings to reflect actual consumption.

12. Therm and kilowatt-hour usage for the current billing period (usage = reading difference x multiplier).
13. Charges for each type of energy.
14. Additional charges - May include California Energy Commission tax, special surcharges as mandated by the California Public Utility Commission, and local taxes.
15. Current and previous month's account activity or charges.
16. Amount due based on energy usage and all other charges.
17. These comparisons indicate how well you are conserving energy on a monthly and daily basis may form the basis of your monthly report. To calculate cost avoidance, the amount of money the district would have paid for gas or electricity if the school had not conserved during the current year, multiply the number of kWh or th saved by the current charge per kWh or th.

    EXAMPLE:
    March 1982 53,000 kWh
    March 1983 35,500 kWh
    17,500 kWh saved

    17,500 x $.08 per kWh = $1,400 cost avoidance.


PG&E
471 PIERROZ ROAD
PLACERVILLE CA 95667
622-0550
NOVEMBER, 1983
DPT31 40001-1
A 12
POWER
DEM CHG 150.66
MOTHER LODE UNION SCH
FORNI RD .2 N/MD FLT
PLACERVILLE CA 95667
SCH
ELEC 1014 11 4 21 8681 8793 112 88 8960 654.73
BILLING DEM 74
CREATED DEM 74
PREV HI DEM 146
PREV HI DEM MO APR
STEEL SURCHARGE ADJUSTMENT 1.61
TOTAL CURRENT CHARGES 659.13
PREVIOUS BALANCE 927.02
NO PYMT RECVD BY 11/03/83
TOTAL AMOUNT NOW DUE
TO IMPROVE EFFICIENCY, METER READING DAYES ARE BEING CHANGED IN SOME AREAS. AS A RESULT, YOUR BILLING PERIOD IS SHORTER THIS MONTH. THIS MAY MEAN A ONE TIME LOWER-THAN-USUAL BILL.
ACCT NUMBER CHANGED FROM MPT 31 40001
BILL PERIOD
GAS THERMS DAYS BILLED
THERMS PER DAY
ELECTRIC KWH DAYS BILLED
KWH PER DAY
THIS MONTH THIS YEAR 21 8960 426.7
THIS MONTH LAST YEAR 32 21280 665.0
DPT31 40001-1
COMPARE YOUR AVERAGE DAILY USE WITH LAST YEAR
FORM 61-4402 REV. 5/83
THIS BILL IS NOW DUE AND PAYABLE
18
19
20

To calculate the percent of increase or decrease in energy consumption or costs, use the following formula:

last year's value—this year's value/last year's value = % change

OR 53,000—35,500/53,000 which equals .33 or 33% decrease.

18. If you are on an electric schedule which charges for electric demand (in addition to electric consumption) the metered demand for the current billing month appears here. Demand billing can be an advantage to schools with low demand as the standard rate per kWh is lower. To reduce the demand charge, sites stagger the times when electrical equipment is operated as noted earlier in the kiln example.
19. For demand accounts, the charge associated with the electric demand for the billing month. To figure cost avoidance with demand billing, you may divide the total kWh usage into the kWh charge to find the "real" cost per kWh.
20. For demand account, this amount includes demand and energy charges.

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